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IDENTIFICATION AND SIGNIFICANCE OF THE CUCURBIT MATERIALS FROM HUACA PRIETA, PERU

BY THOMAS W. WHITAKER[1] AND JUNIUS B. BIRD

CONTENTS

THE ARCHAEOLOGICAL BACKGROUND[2]

The cucurbit materials described by Dr. Whitaker were recovered at a site known locally as the Huaca Prieta on the coast line of the Chicama Valley, Peru, at about latitude 8° S. Despite severe erosion, the huaca, a large compact midden, still has a

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[2] This field work was a part of the Andean Institute-Virú Valley survey, a coöperative undertaking shared by the American Museum of Natural History, the Chicago Natural History Museum, the Smithsonian Institution, and Columbia and Yale Universities, 1946–1947.

maximum thickness of 45 feet. To determine its nature and contents, blocks or columns of debris were isolated and then separated into successive layers by following the visibly traceable strata. In one pit (HP-3) 22 such layers, some subdivided into several parts, spanned the full period of occupation of the site. As study of the collection proceeds, it appears from the distribution of certain items that the material of these layers can be grouped into six or seven chronological units.

A second pit (HP-2) provided additional material roughly contemporaneous with the lower six levels or first two units of the larger section. In both excavations the dirt was screened, and all plant remains and artifacts were saved. Because of ideal conditions for preservation, the quantity of perishable material exceeded all expectations. As an example, the squash and gourd remains from these two pits amounted to over 11,000[1] shell fragments, 1300 seeds, and about 550 peduncle fragments. Of this pre-ceramic material only that from Layer M in HP-3 was sent to Dr. Whitaker for study. This did not include 1500 shell fragments from this layer discarded after the field record was made. The series for study was selected for various reasons: its position well down in the mound near the lower limits of best preservation, the high yield of this particular layer, and a hope that it would prove to be an adequate sample, since it apparently contained examples of everything found in the other layers.

As preliminary reports (Bennett, 1948; Bird, 1948) on this excavation have appeared and as a monograph is in preparation, my comments are limited to details that explain the setting and supplement Dr. Whitaker's study.

From the excavations it was clear that the concentration of debris was the result of continuous occupation of a limited area by a people whose economy was based partially on agriculture, partially on fishing. Their material culture was in some respects quite primitive. In view of the subsequent ceramic record in Peru, it is of general interest that they had no knowledge of pottery. This and other evidence indicate considerable antiquity for the remains, prompting a guess that we are dealing with a culture period which may fall between 3000 and 1000 B.C.

The plants utilized during this period, except for the Cucur-

[1] In order to compensate for the breakage resulting from excavation and handling, the small shell fragments showing fresh fractures were grouped by three's and counted as the equivalent of one unbroken piece.

bitaceae, have been tentatively identified. Beans of at least three varieties (all *Canavalia*?), chili peppers, cotton, and canna were probably cultivated. Evidence for the latter consists principally of many scraps of the rhizome skin and some leaves. Definitely wild, but commonly utilized as food, were the small tubers from *Scirpus* (*americanus*?) and *Cyperus* sp.? Roots of cat-tail seem also to have been eaten. Important fruits were the *Lucuma* and *Bunchosia* sp.? Two other plants, as yet unidentified, were of considerable economic importance: one provided bark for barkcloth, and the second, possibly *Agave*, yielded a bast fiber used to some extent in combination with cotton in the production of many fabrics. In this period there was no evidence for the presence of maize.

Utilization of Gourds

Among the 10,770 gourd shell pieces for which we have relative position data in HP-3, only 358 (3.3 per cent) give some clue as to their use. An additional hundred bear some slight indication of having been cut or worked in some manner. This percentage is so low that it might well be misleading to limit the discussion to the gourd shells found with the Layer M material. Thus the following is based on an analysis of the 358 specimens which are classifiable into four categories: containers, 72.4 per cent; fish-net floats and float stoppers, 15.1 per cent; discs of unknown use, 5 per cent; and fragments of scoops or ladles, 7.5 per cent.

Containers: Among these, open-mouthed bowls predominate, all made by sectioning the gourd transversely. This, unlike a longitudinal cut, yields only one container per gourd. Usually the incision was made high enough so the bowl rims were incurving; very few were cut where the fruit reaches its maximum diameter. One rim fragment of this latter type, found in the top level of the pre-ceramic debris, has an indicated diameter of 40 to 42 cm. Another, found midway between this and the M layer, apparently measured 34 cm. in diameter. These sizes are exceptional; as a rule the bowls were under 22 cm. in diameter, with a possible depth of 10 or 12 cm.

The short-necked type of *Lagenaria siceraria*, with the neck cut off, produced a constricted-mouth jar form. These vary considerably in size and rim profile. Cuts made farther up on the neck of the long-necked *L. siceraria* yielded a bottle form, but it is impossible to distinguish with certainty whether the fragments

are from these bottle forms or from fish-net floats. The same type of gourd served as small spherical containers about 6 cm. in diameter. Remains of two of these had been fitted with flattened circular covers cut from a much larger specimen.

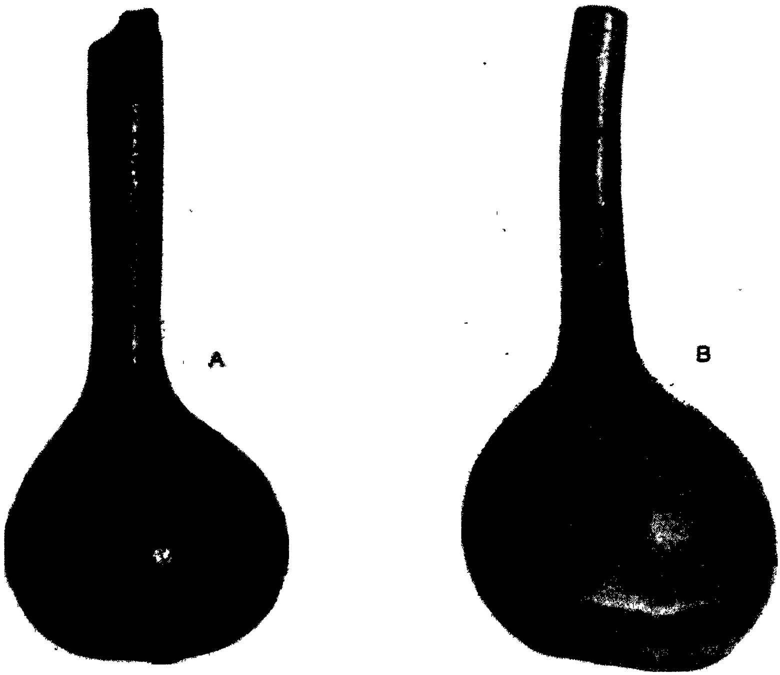

FIG. 1. Fruits of *Lagenaria siceraria* from Huaca Prieta. A. Virtually intact fruit, Test 5; probably used for fish-net float. B. Fruit of *L. siceraria*, Test 3; used for fish-net float.

The only other objects here classed as containers are a few fragments, also of the long-necked *Lagenaria siceraria*, which have had part of one side removed to form a dipper. The relative frequencies of these and the other types of containers are as follows:

	PER CENT
Bowls, incurving rims	80.4
Bowls, flaring or vertical rims	6.9
Jar form, constricted mouth	5.4
Bottle form	4.3
Small spherical containers	1.1
Dippers	1.9

FISH-NET FLOATS: The fortunate discovery of a large fish net with eight floats attached and still intact positively identifies these objects. All have the tip of the neck cut off and the seeds removed, though a few still remained in the one sent to Dr. Whitaker (figs. 1B, 3C). The openings are plugged with gourd shell discs from 10 to 22 mm. in diameter. Such small discs occur from top to bottom of the mound, sometimes still in place in a float neck fragment. Gourd floats are still used along this coast, but none of the long-necked forms were observed nor are the seeds removed as in the past.

DISCS: Discs larger than those used in the floats occur in the upper third of the midden. Plain, smooth-edged discs vary in diameter from 3 to 7 cm. Rough-edged discs with one, two, or three perforations near the margin are slightly larger. Another well-finished example has 12 small punctures at the margin and four holes at the center in which cords remain.

SCOOPS OR LADLES: Various fragments of roughly oval and angular objects with worn or smoothed edges can perhaps be classed as ladles. The absence of complete specimens and the lack of uniformity among the fragments make a clear description difficult. Apparently any broken gourd fragment of sufficient size was suitable as a makeshift spoon for stirring or serving food. One occasionally sees such pieces in use today and though they are not cut to a specific pattern they are nonetheless real utensils.

DECORATIVE TECHNIQUES: In the entire lot of shell fragments, all from containers, only 13, or one in 830, were decorated. With such a low rate of occurrence, it is surprising to find several distinct methods of decoration.

Crudest are those with lines and marks made by scratching off the epidermis when it was fresh and soft. In nearly all the incurved rim bowls, the epidermis has been removed just below the lip for a distance varying from 3 to 15 mm., but I hesitate to class this as a decorative feature. Fine line incising in the hard shell was used for diagonal crosshatching in two instances. Five

pieces show pyro-engraving in tantalizingly incomplete fragments of decoration. Two show rather skilful carving of geometric stylized faces. In these, both the design and the quality of work lead us to believe that they are not casual or experimental products, but rather that the method of decoration may have some traditional background. If this is true, then the rarity of decoration is still more of a puzzle.

REPAIR OF BROKEN GOURDS: Broken containers were sometimes repaired by lacing the cracks with cotton cord. Examples are so poorly executed as to suggest that gourds were so abundant that skilful repairing was unnecessary.

MATERIAL ASSOCIATED WITH EARLY CERAMICS

After the work in the main mound was completed, additional excavations in a smaller accumulation immediately to the north exposed more pre-ceramic debris underlying and blending with pottery-bearing refuse. This provided sufficient material, both botanical and cultural, to establish the relation of the pre-ceramic horizon with the known Cupisnique-Chavín culture. The latter has been described on the basis of the more durable artifacts, and little else relating to it has been found. The nearly simultaneous appearance for the first time in this part of Peru of several plants, maize, peanuts, avocados, *inga*, and a "warty" squash, together with new textile techniques and the Cupisnique ceramics, implies the arrival here of migrants from another region. Items marked HP-5 are from this period and were removed from a considerably smaller volume of debris than that examined in HP-3. Although over 16,500 fragments of pottery were taken from it, the yield of squash and gourd remains was small: 1721 shell fragments, of which 137 are from the warty squash, 144 peduncles, and perhaps a hundred seeds.

The analysis of the gourd shell pieces compared with the pre-ceramic material reveals some distinctions. Diagnostic specimens, that is, those of determinable use, constitute 5.8 per cent of the total. The proportion of decorated fragments is much higher, one in every 28, or 3.5 per cent of the total. The only method represented is pyro-engraving, with which a variety of curvilinear designs was created. In addition to the bowl forms already mentioned, there are three fragments from bowls made by cutting the fruit longitudinally. The bottle form containers are represented, but the small spherical type, the dippers, and ladles were

not found in this lot. Unique is a whistle made from a nearly spherical shell, 4 mm. thick, 45 mm. long, and 47 mm. in diameter (fig. 2). The seeds had been removed by cutting out the peduncle

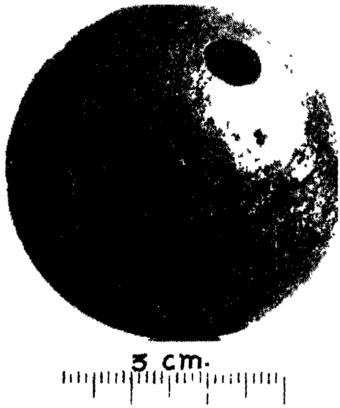

FIG. 2. Spherical fruit of *Lagenaria siceraria* made into whistle. Found with Cupisnique ceramics and early maize (HP-5-A3).

scar and after the insertion of a round clay (?) pellet the hole was closed with a gourd disc. The pellet does not now affect the sound of the whistle made by blowing across a small vent.

SUMMARY

The preceding comments relate primarily to the utilization of the *Lagenaria siceraria* identified by Dr. Whitaker. Whether, in addition, they were ever eaten might be determined by an examination of the coprolites collected. The *Cucurbita*, on the other hand, were obviously an important food. The significance of their presence in this early horizon remains to be evaluated, and the explanation will more likely be supplied by botanists than by archaeologists. Actually we have no clue as to the original home of these people, and unfortunately the nature of their artifacts is such as to promise great difficulty in tracing them. Hence such contributions as Dr. Whitaker's botanical analysis are most welcome.

BOTANICAL IDENTIFICATION AND SIGNIFICANCE

Through the courtesy of Mr. Junius Bird, the writer has been privileged to examine and study the remarkably well-preserved cucurbitaceous materials excavated at Huaca Prieta. The well-organized, systematic excavations directed by Mr. Bird have uncovered some very significant plant material, and a preliminary report (Bird, 1948) has established the fact that the peoples occupying this site were among the earliest agriculturists in the New World. The cucurbit materials are of such importance for ethnobotanists, archaeologists, and others that a separate report of their analysis and identification seems justified.

METHODS

For the most part the cucurbit material submitted for examination was in an excellent state of preservation, considering its age. The shells[1] of both *Lagenaria* and *Cucurbita* were in good condition, and in some instances the fruits of *Lagenaria* were recovered virtually intact (fig. 1). The seeds were not so well preserved as the shells. For some specimens, erosion of the outer seed coat and general deterioriation through age made positive identification impossible.

A method for softening and decolorizing the tissue of the walls of the shells and mounting it for microscopic examination has been described previously (Whitaker, 1948). Whenever a particular fragment could not be positively identified as either *Lagenaria* or *Cucurbita* by macroscopic means, it was sectioned and examined microscopically. The histological pattern of the walls of the shell is so different for the two genera that rapid and positive identification is a routine matter.

The seeds of *Lagenaria siceraria* (Molina) Standley are quite distinctive and can easily be identified by inspection. Seeds of *Cucurbita* were checked with the extensive collection maintained

[1] In a previous paper, the author (Whitaker, 1948) used the term "exocarp" to designate the remains of the fruit, i.e., the so-called "shells" or "rind." Dr. R. M. Brooks, Associate Pomologist, University of California, informs me that this term is not applicable to fruit with an inferior ovary, where the carpels are surrounded by accessory tissue. According to Dr. Brooks, the morphological nature of the mature pepo has not been satisfactorily worked out, and for this reason a meaningful term to describe the hard, dry, tough, and brittle remains of the fruit has not been suggested. In the meantime the word "shell" has been applied to these fragments, with the understanding that it has no status in botanical terminology.

at this laboratory. By comparison it was possible to determine rather accurately the precise affiliation of the archaeological seeds.

MATERIALS

A list of the cucurbit materials follows, with notes on their identification and other pertinent comments:

PRE-CERAMIC, PRE-MAIZE GOURDS AND SQUASH; HUACA PRIETA, TEST 3

HP-3-M

81 stems

This collection of peduncles appears to be chiefly those of some species of *Cucurbita*, probably *C. ficifolia*, Bouché. There are a few that may be *Lagenaria siceraria*, but certainly most of them are *Cucurbita*

62 roughly spherical shells with stem scars

Evidently most of this material is some species of *Cucurbita*, probably *C. ficifolia*. Shells range in thickness from 2 mm. to 3 mm. A majority of the fragments have peduncle scars. However, about one-third are from the distal portion of the fruit with the scar and depression from the withered flower parts

11 thin shells, like the preceding

All except 2 of these shells are almost certainly those of some species of *Cucurbita*, probably *C. ficifolia*. The two exceptions have a wall thickness of 3.5 mm. and 4 mm., respectively, and when sectioned proved to be *Lagenaria siceraria*. The remainder have walls averaging about 2 mm. in thickness

12 bottle gourd necks

This collection consists of 12 fragments of the neck portion of the fruits of *Lagenaria siceraria*. The fruits were evidently of the short-necked type; 6 of the fragments retain vestiges of the peduncle. In one case, the portion of the peduncle remaining attached to the neck fragment was approximately 10 mm. in length. The shells are of varying thickness (4 mm. to 8 mm.)

5 centers of base

Fragments from distal portion of the fruit, with depressed area and scar from withered flower parts. Two are an unidentified species of *Cucurbita* (these were sectioned), wall thickness average, 2.5 mm.; the remainder are *Lagenaria siceraria*, wall thickness, 5 to 6 mm.

33 samples of gourd shell showing range in thickness

This collection consists of 33 fragments of shells of *Lagenaria siceraria*. The range in shell thickness for the entire group varies from 4 mm. to 9 mm.; in area from approximately 150 sq. mm. to 2700 sq. mm.

Seeds as listed on field analysis:

12 seeds of *Lagenaria siceraria*

The seeds in this collection show some of the extreme broadness and size characteristic of those in collections of these species from the Old World (fig. 3D)

FIG. 3. Seeds of cucurbits from Huaca Prieta, showing range of size and shape of mature seeds. A. *Cucurbita ficifolia*. B. *C. moschata*, fringed-margined variety. C. *Lagenaria siceraria*, seeds taken from net float (fig. 1B). Note small size and absence of paired protuberances. D. *L. siceraria*, broad, flat type of seeds characteristic of the Old World collections of this species. Millimeter scale at bottom.

18 seeds

These are the seeds of the fig-leaf gourd, *Cucurbita ficifolia* (fig. 3A)

1 large batch of seeds

These are mostly seeds of an unidentified species of *Cucurbita*, probably *C. moschata*, Duchesne, since some of them have a fringed margin (fig. 3B). There is a single seed that appears to be of *C. ficifolia*. There are also a few of *Lagenaria siceraria*

HP-3-G

1 bottle gourd net float and seeds removed from it

Lagenaria siceraria, relatively long-necked type; over-all length, 242 mm.; length of neck, 135 mm.; maximum diameter of bulbous portion, 120 mm. Peduncle end corked with tightly fitted plug apparently of same material. Seeds typical of *L. siceraria* found in archaeological collections from South America: average length, 13 mm.; average width, 6 mm. (see fig. 3C)

GOURDS AND SQUASH ASSOCIATED WITH CORNCOBS AND CUPISNIQUE POTTERY, HUACA PRIETA, TEST 5

HP-5-A1

1 fragmented gourd bowl

Shell 6 mm. thick

6 gourd fragments

Shells ranging from 5 mm. to 10 mm. in thickness

2 stems

1 peduncle 20 mm. in length; the other with a portion of the shell adhering to the peduncle, about 12 mm. long. All the above items are undoubtedly *Lagenaria siceraria*

HP-5-B

2 bottle gourd necks

Neck portion of *Lagenaria siceraria* fruits; one 30 mm. long with shell 3 mm thick; the other 37 mm. long with shell 5 mm. thick

1 bottle gourd container

Lagenaria siceraria, fragmented, evidently a rather small or immature fruit, the remaining portion appears to be about one-half of the original container; shell wall, 5 mm. thick

1 bottle gourd bowl rim fragment

Lagenaria siceraria, apparently from rim of container used as a bowl; area, 2200 sq. mm., shell wall, 5 mm. thick

6 warty squash fragments

Shell fragments of some warty *Cucurbita,* almost certainly *C. moschata*

7 stems

Peduncles of *Lagenaria siceraria* and unidentified species of *Cucurbita*

HP-5-B8

19 stems

Peduncle fragments; all but 1 are classified as *Cucurbita ficifolia* The single exception is a peduncle with a portion of the shell attached. Since the attached shell is warty, it is probably some species of *Cucurbita,* most likely *C. moschata*

7 warty squash fragments and 2 shells with stem scars

9 shell fragments of *Cucurbita* sp.; 6 are warty, 3 are smooth; one of the latter may be *Lagenaria siceraria.* The warty shells are probably those of *C. moschata* and are from 1.5 mm. to 3.5 mm. in thickness The smooth shells vary from 1.5 mm. to 3 mm. in wall thickness

HP-5-B8

Large collection of seeds of *Cucurbita* sp.

Most of them badly eroded, and damaged, perhaps by animals. One seed is definitely *C. moschata;* the remainder are probably *C. ficifolia*

HP-5-House 5, Huaquero pit at entrance

1 bottle gourd

Much the same type as that used for net float (see fig. 1A); over-all length, 245 mm.; neck length, 145 mm.; maximum diameter of bulbous portion, 115 mm.; wall, 4 mm. thick

1 gourd bowl

Broken, fragmented, large; maximum diameter, 173 mm.; wall, 6 mm. thick: *Lagenaria siceraria*

Squash seed and gourd seed associated with pottery of Cupisnique and pre-Cupisnique type

HP-5, between Floors 1 and 2 of House 7
Cucurbita ficifolia

HP-5-A, general
2 seeds of *Lagenaria siceraria;* 1 small immature seed of *Cucurbita moschata*

HP-5, House 2
1 of *Lagenaria siceraria;* 1 *Cucurbita ficifolia;* 1 *C. moschata*

HP-5, House 5
In poor condition, many appear to be immature; 7 can be positively identified as *Cucurbita moschata;* the remainder are *C. ficifolia*

HP-5-A2
7 seeds of *Cucurbita ficifolia;* 3 of *C. moschata;* 3 of *Lagenaria siceraria*

HP-5-A3
2 seeds of *Lagenaria siceraria;* 5 of *Cucurbita moschata;* the remainder are *C. ficifolia*

HP-5-A4
1 seed of *Cucurbita ficifolia* and several immature seeds of unidentifiable species of *Cucurbita*, possibly *C. moschata;* the remainder are *Lagenaria siceraria*

HP-5-B1
2 seeds of *Cucurbita ficifolia*

HP-5-B6
1 seed of *Lagenaria siceraria*, and 1 seed of unidentified *Cucurbita* badly deteriorated but probably *C. ficifolia*

HP-5-B10
Mostly in poor condition; 6 seeds of *Cucurbita moschata;* the remainder *C. ficifolia*

HP-5-B11
1 seed of *Lagenaria siceraria* and 1 of *Cucurbita ficifolia*

HP-5-C4
2 seeds of *Lagenaria siceraria;* the remainder are in poor condition but are evidently some species of *Cucurbita;* at least 4 are *C. ficifolia* and 3 are *C. moschata*

HP-5-D1
1 seed of *Cucurbita ficifolia*

HP-5-D2
1 seed of *Lagenaria siceraria;* 3 seeds of *Cucurbita ficifolia;* remainder small seeds with fringed margin, *C. moschata*

Discussion and Conclusions

The material from the pre-ceramic, pre-maize horizon at Huaca Prieta indicates that *Lagenaria siceraria* and two species of *Cucurbita* (*C. ficifolia* and *C. moschata*) were being cultivated during this period. The abundant materials of *L. siceraria* suggest that it was widely used for a number of purposes by the inhabi-

tants of this site (see p. 3). The large, broad seeds (see fig. 3D) show a striking resemblance to the Old World collections of this species. This point may or may not have some significance. However, it does seem important to note that they are markedly unlike the small narrow seeds, mostly without paired protuberances, characteristic of other South American archaeological collections of this species (compare figs. 3C and 3D). This new information suggests that if *L. siceraria* is a native of the Old World, it was introduced into South America at a very early date. On the other hand, there is no clear evidence that negates the idea that this species was a New World endemic and was domesticated in the Americas.

There is good evidence from the peduncles, shell fragments, and seeds that *Cucurbita ficifolia* was cultivated contemporaneously with *Lagenaria*. In addition, there is some indication from the seeds (one large batch of seeds) that another species of *Cucurbita* was present. The fringed margins of these specimens permits one with some confidence to assign them to *C. moschata* (Whitaker and Bohn, in press). In this group are found the modern varieties Sugar Marvel, Butternut, etc. However, at this horizon no substantiating evidence from peduncles or shells has been discovered.

Thus from the pre-ceramic, pre-maize horizon there is evidence for the presence of three species of the family Cucurbitaceae; first, abundant material of shells, peduncles, and peculiar broad seeds of *Lagenaria siceraria;* second, peduncles, seeds, and possibly shells of *Cucurbita ficifolia;* third, seeds of *C. moschata.* The estimated date for the beginning of this horizon is about 3000 B.C. (Bird, 1948).

Coming to the corncob, Cupisnique pottery horizon, *Lagenaria siceraria* is still present in abundance, but there are no specimens of the broad-seeded form found in the earlier horizon. *Cucurbita ficifolia* continued to be cultivated, although the seeds of this species are somewhat different from those associated with the pre-ceramic, pre-maize horizon in that they seem to be specimens from the dingy white-seeded form of this species rather than the black-seeded form characteristic of the older horizon.

A new element, the warty squash, enters the picture at this point, occurring stratigraphically slightly earlier than maize. It is probably a form of *Cucurbita moschata.* Warty varieties are found in *C. moschata, C. pepo,* and *C. maxima,* but warty forms of

C. ficifolia are unknown. *Cucurbita pepo* is strictly North American in origin and distribution. Thus *C. moschata* and *C. maxima* remain as possibilities. There is considerable evidence that *C. moschata* is endemic in the northern portion of South America, i.e., Peru and Colombia, while *C. maxima* is native to southern Brazil and northern Argentina. Additional evidence is supplied by the seeds which are typical of those with a fringed margin characterizing some varieties of *C. moschata* (Whitaker and Bohn, in press). Furthermore, none of the seeds in the entire collection resembled *C. maxima.*

It is probable that the variety of *C. moschata* cultivated at this time had a warty exterior and seeds with a pronounced, fringed margin. However, it must be remembered that warty shells were not associated with fringed-margined seeds in the earlier horizon.

Varieties of *Cucurbita moschata* with fringed-margined seeds must have had a widespread distribution in Peru during pre-contact times. Carter (1945) reports seeds of this type in the Uhle collections from Chincha, Peru. The chronology is given as late pre-Columbian (*ca.* 1300–1500 A.D.).

If *Cucurbita ficifolia* was cultivated by the peoples of this period, and the evidence is very good in this respect, its presence deserves special comment. *Cucurbita ficifolia* has never been reported from archaeological collections in either North or South America. It has generally been considered to be endemic in Mexico and Central America. Its presence in Peru at this early date is a puzzle, unless we assume that it is widely adapted. If so, it could have been carried northward by a succession of early migrations.

To summarize, the most important facts brought out by examination of the cucurbitaceous materials from Huaca Prieta are: 1, there is abundant material of *Lagenaria siceraria* present in both horizons; 2, in the pre-ceramic, pre-maize horizon there are seeds of the broad-seeded form of *L. siceraria*, typical of collections of this species from the Old World; 3, a black-seeded form of *Cucurbita ficifolia* is present in the early horizon, and a dingy white-seeded form in the later horizon; 4, in the pre-ceramic, pre-maize horizon, there are fringed-margined seeds of *C. moschata;* 5, in the later horizon (corncob, Cupisnique pottery) there are warty shells of some variety of *C. moschata;* associated with these warty shells are fringed-margined seeds of the same species.

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A TELEOST FROM THE LIVINGSTON FORMATION OF MONTANA

By Bobb Schaeffer

INTRODUCTION

The single specimen of a fossil fish described in this paper represents the first reasonably complete fossil vertebrate to be recorded from the so-called Livingston formation. It was found in 1947 by James A. Wilsey, a graduate student at Princeton University, in the Madison Range of southwestern Montana in fresh-water varved shales associated with basalts, volcanic agglomerates, and tuffs. Repeated attempts to obtain additional specimens have been unsuccessful, but the unique occurrence of this individual plus its curious assemblage of characters make it worthy of detailed consideration.

It was hoped that the fish would provide some clue regarding the age of the beds in which it was found. Although all indication of actual bone has disappeared, the remaining impression of the specimen is preserved in the finest detail, and it has been possible to prepare accurate and informative latex impressions. The question of taxonomic affinity, at first considered to be of no particular difficulty, became more and more involved as the observable characters were assembled and evaluated. It became obvious that the specimen cannot supply the desired data as to geologic age, even in a broad sense, and that its systematic position cannot be determined with absolute surety.

The higher categories of fishes are based, perhaps to a greater degree than equivalent categories in any other vertebrate group, on suites of characters that are not mutually exclusive. This implies that there are often many characters shared in common by categories of equal rank and that the characters themselves are

not so important taxonomically as the particular diagnostic combination in which they occur. This situation has led to extreme differences of opinion regarding the composition and relationships of many of the systematic units. It would appear that one of the greatest problems in teleost classification has been the difficulty of evaluating taxonomically a reasonably consistent series of morphological characters (including those that can be observed in fossils) that are of probable diagnostic value. Obviously, within the various ramifications of teleost phylogeny different morphological characters or character complexes will be of diagnostic significance at a given taxonomic level. The taxonomic evaluation will depend to a large degree on the tempo and mode of evolution observable in the various major and minor categories. Much has already been accomplished in this direction, but a new synthesis of taxonomic characters at familial and ordinal levels is badly needed. For this purpose new data, in addition to those present in the literature, are required.

The problem just discussed has been brought forcefully to mind in attempting to classify the form herein described. For example, the internal structure of the caudal fin and the form of the pelvic bones can be determined with considerable accuracy, as they can in most fossil teleosts that are fairly well preserved. The characteristics of these structures have been little used taxonomically, however, and the specimens are not at hand for extended comparisons, particularly among the living fishes.

As the observable diagnostic characters of the fish from the Livingston formation do not clearly place it in any known family of teleosts, the specimen was submitted to several ichthyologists for their consideration. All agree that it represents a real taxonomic puzzle, and at least one feels that it is a representative of a new family.

Wilsey was planning to prepare a synopsis of the pertinent stratigraphic evidence, but this was unfortunately not accomplished before his regrettable death from poliomyelitis on January 10, 1949. The writer is indebted to Dr. G. L. Jepsen for supplying such information as is now available. He is also obligated to Drs. C. M. Breder, Jr., G. A. Myers, E. M. Nelson, and L. P. Schultz for their opinions regarding the possible systematic position of the specimen.

TAXONOMY AND DESCRIPTION

ORDER ?ISOSPONDYLI

SUBORDER ?CLUPEOIDEA

OSTARIOSTOMIDAE, NEW FAMILY

TYPE: *Ostariostoma*, new genus.

DISTRIBUTION: Known only from Livingston formation, Upper Cretaceous or Paleocene, North America.

DIAGNOSIS: Small, fusiform, isospondylous-like fish of doubtful ordinal and subordinal affinity. Gape small and nearly vertical, jaw articulation in front of orbit, upper jaw bordered by premaxillary and maxillary, teeth on premaxillary and dentary. Intermuscular bones minute or possibly absent. Postcleithrum absent or completely covered by cleithrum. Last two vertebrae upturned, ultimate forming elongated urostyle, hypurals moderately expanded and unfused. Dorsal and anal fins characin-like in form and arrangement.

OSTARIOSTOMA,[1] NEW GENUS

GENOTYPE: *Ostariostoma wilseyi*, new species.

GENERIC DIAGNOSIS: A fish of possible isospondylous relationship, but differing from all known genera in this order by the following combination of characters: Body fusiform, elongate, skull contained in total body length about 5.5 times. Greatest depth about one-sixth of total length. Premaxillary and dentary with relatively large, conical, pointed teeth. Maxillary wide distally, entering jaw margin, edentulous. Supramaxillary bones not definitely indicated. Gular probably absent. Ossified interorbital septum absent. Preopercular L-shaped, opercular bone large and almost covering subopercular. Branchiostegals five. Vertebrae well ossified, 39–41, abdominal 19–21, caudal 20, including urostyle. Last vertebra modified into elongated urostyle. About nine unfused, expanded, delicate hypurals. Ribs long, delicate, reaching ventral border. Parapophyses reduced. Origin of pectoral fin low, with about eight rays. Pelvic fin origin abdominal, about halfway between origins of pectoral and anal, about seven rays. Single dorsal fin triangular with origin near middle of body, eight rays, longest about equal to skull length. Anal fin extended, 19 rays, origin posterior to that of

[1] ὀστάριον, small bone, and στόμα, mouth. The name is not meant to imply any demonstrated relationship to the Ostariophysi.

dorsal. Caudal fin moderately forked, epichordal and hypochordal lobes of about equal size.

Ostariostoma wilseyi, new species

TYPE: Princeton University Geological Museum No. 14728. Only known specimen consists of a detailed impression of a complete fish.

HORIZON AND LOCALITY: Fresh-water varved shales of the Livingston formation, Upper Cretaceous or Paleocene. Wilsey's field notes indicate, with a fair degree of certainty, that the specimen was obtained at Raw Liver Creek (? trib. Indian Creek), Sec. 17, T. 8 S., R. 3 E., Madison County, Montana. During the summer of 1948, Wilsey discovered a rather prolific fossil leaf horizon in the same general area, which may permit a more accurate dating of this portion of the Livingston formation. The complexity of the geologic structure, however, made it impossible to determine the exact stratigraphic relationship between the plant-bearing beds and the fish horizon.

SPECIFIC DIAGNOSIS: Only known species of the genus.

MEASUREMENTS, IN MILLIMETERS

(Longitudinal measurements were taken from the tip of the premaxillary along the axis of the vertebral column)

Total length	49.0
Standard length (incl. urostyle)	39.5
Skull length	8.3
Distance from snout to anterior border of:	
Dorsal fin	22.7
Pelvic fin	16.5
Anal fin	26.5
Body depth at origin of dorsal fin	7.0

DESCRIPTION: The skull roof is smooth and without indication of excavation in the otic region. The supraoccipital lacks a crest projecting above the general level of the roof. The superior border of the orbit is bounded by an elongate, splint-like element that is probably a supraorbital or prefrontal. It bears about the same relationship to the "lacrymal" as the similarly situated bone in many primitive clupeoids and some characins. The parietal, if correctly identified, extends as far medially as the probable median border of the frontal and presumably joined its fellow of the opposite side. The otic and occipital areas are obscure, and little can be determined regarding them. The parasphenoid runs obliquely

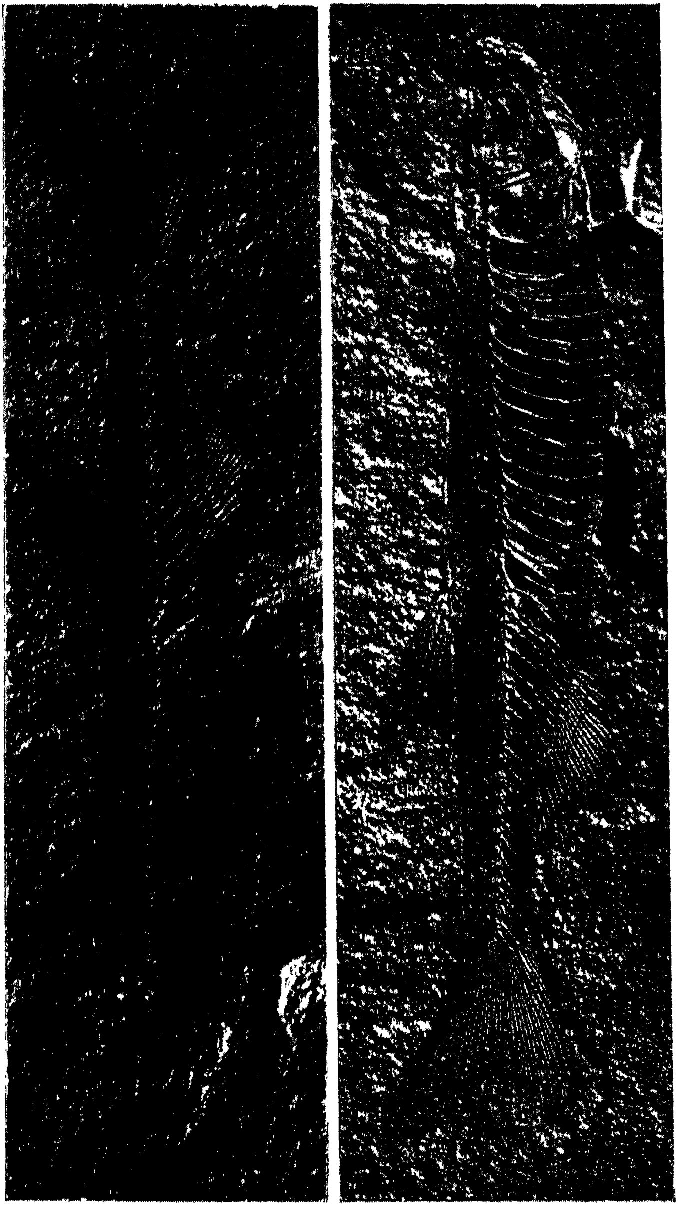

FIG. 1. *Ostariostoma wilseyi.* A. Latex cast of type, × 3/1. B. Princeton Mus. No. 14728, type and only known specimen, preserved as a complete and detailed impression, × 3/1.

downward and posteriorly in a manner suggestive of *Chatoëssus*. The braincase extends backward to about the middle of the dorsal surface of the opercular, a relationship commonly associated with forward jaw suspension.

The elements involved in the jaw suspension have undoubtedly been displaced forwardly and dorsally, resulting in an anterior and upward displacement of the upper and lower jaws. The dentigerous portion of the premaxillary is about half the length of the maxillary. It supports between 15 and 20 relatively long, pointed teeth of more or less equal size, closely spaced, and, as nearly as can be determined, in a single row. The posterior border of the premaxillary has a rather prominent rounded process that presumably fitted against the outer surface of the maxillary, indicating that the latter partially overlapped about the lower third of the premaxillary. The ascending process of the premaxillary appears to be very short, suggesting but a slight degree of protrusion, if any.

The maxillary is edentulous and widens rapidly ventrally. The presence of one or more supramaxillaries cannot be definitely demonstrated, although the marked distal expansion of the maxillary plus certain indications on the latex cast suggest that they may be present. The dentary has a rounded symphyseal region. Its dentigerous border rises rather rapidly to the coronoid region, resulting in a fairly deep mandible that is characteristic of many fishes with a forwardly directed suspensorium. The teeth, as in the premaxillary, are relatively long, pointed, single cusped, and circular in cross section. There are at least 10 teeth indicated in the specimen.

The infraorbital series consists of four or five elements and has a marked ventral curvature which is probably real and not due to crushing. The preorbital is the largest of the series, and the posterior members show no evidence of expansion as in the chirocentrids, characins, and other groups of suggested affinity.

The nature of the hyopalatine complex cannot be observed. The quadrate is present below the second suborbital and is of the usual triangular shape. Its extreme forward position indicates a reduced pterygoid and palatine and probably much expanded entopterygoid and metapterygoid elements. The hyomandibular has a slight forward inclination or is nearly vertical. The symplectic is elongated, rod-like, and nearly horizontal.

The horizontal and vertical rami of the preopercular are of

equal length and meet at essentially a right angle. The horizontal ramus is about half the total skull length. The opercular is much larger than the subopercular and is very similar in shape to that of the cyprinids. The dorsal border of this bone is essentially horizontal, while the posterior and ventral borders form a continuous curve that meets the straight anterior border in a sharp point. The latex cast shows some indication of concentric growth lines on the opercular as well as a few radiating ridges near the posterior border. The subopercular is also of a form similar to that found in the cyprinids. The interopercular is elongated along with the horizontal arm of the preopercular. The hypobranchial skeleton is not exposed. Five rod-like branchiostegals extend from under the interopercular.

There are 39 to 41 vertebrae, including the urostyle, of which 19 to 21 are abdominal and 20 caudal. Repeated examination has failed to indicate any positive evidence of modification towards the Weberian condition in the first three abdominal vertebrae. Until this can be demonstrated on the basis of additional specimens, or until other exclusively ostariophysial characters are found, relationship with this group cannot be properly considered. The first two vertebrae seem to lack the slender neurapophyses characteristic of the more posterior vertebrae, and there is some indication of short, expanded, neural processes that may be fused. This is by no means certain, however. The ribs in this area are obscured by the shoulder girdle and opercular. The vertebral centra are well ossified, although crushing, particularly of the anterior abdominals, prevents detailed examination. They are hourglass shaped and appear to have a single lateral lamina. The length of an individual centrum is about a third greater than the diameter. The ribs articulate low on the centra without the intervention of well-defined parapophyses; they extend to the ventral border and remain almost of the same width throughout their length. The haemapophyses are slightly expanded proximally, tapering to a point distally. The neurapophyses are delicate throughout the length of the column and show little if any regional variation in length or diameter.

The apparent absence of intermuscular bones is difficult to understand if *Ostariostoma* is an isospondyl or, for that matter, a member of any derived order normally possessing them. A few very faint markings are indicated on the specimen, which suggest these elements were very delicate, to the extent of making practi-

cally no impression. The undisturbed condition of the entire skeletal impression seems to preclude any possibility of removal of the intermuscular bones by predators, current action, or other external agency.

The dermal shoulder girdle consists of the posttemporal, supracleithrum, and cleithrum. The posttemporal is a relatively large triangular element that has most certainly been displaced ventrally and somewhat caudally. It is most unusual in having but a single, much elongated process that may be the extension articulating with the pterotic. In all other teleosts examined the process reaching the epiotic or supraoccipital is usually much longer and more robust. In the case of *Ostariostoma*, the possible complete absence of an epiotic process as an ossified structure is striking. It may very well have existed as a ligamentous connection, a situation that is known to exist to varying degrees for the pterotic process. As preserved, the large posttemporal practically covers the splint-like supracleithrum, the latter being very suggestive of its shape in the cyprinids. The apparent absence of a postcleithrum in *Ostariostoma* must be regarded with caution as it may be covered entirely by the cleithrum. This element is present in all the families considered with the exception of the Dalliidae, and the possible exception of the Esocidae, where it is said to be absent (Chapman, 1934) or present as a single ray of bone (Starks, 1904). There is no indication of this bone in any of the prepared skeletons of *Esox* examined for this study. The presence or absence of the postcleithrum in *Paleoesox* (Voigt, 1939) cannot be determined, as the pertinent area is covered by the opercular.

The anterior and dorsal limbs of the cleithrum are about of equal length. The ventral surface of the anterior limb is not expanded, and the elongated ventral process of the coracoid appears to be exposed, extending anteriorly about as far as the cleithrum. A poorly preserved rugose mass above the origin of the pectoral fin may represent that portion of the scapula and adjoining coracoid articulating with the fin radials.

The pectoral fin is incomplete, and its ventrally directed position indicates that the median side is exposed. About six delicate rays can be counted, but there may have been more. The fin was long and narrow.

The pelvic bones are narrow, elongated triangles with no indication of anterior forking or of the presence of posterior processes.

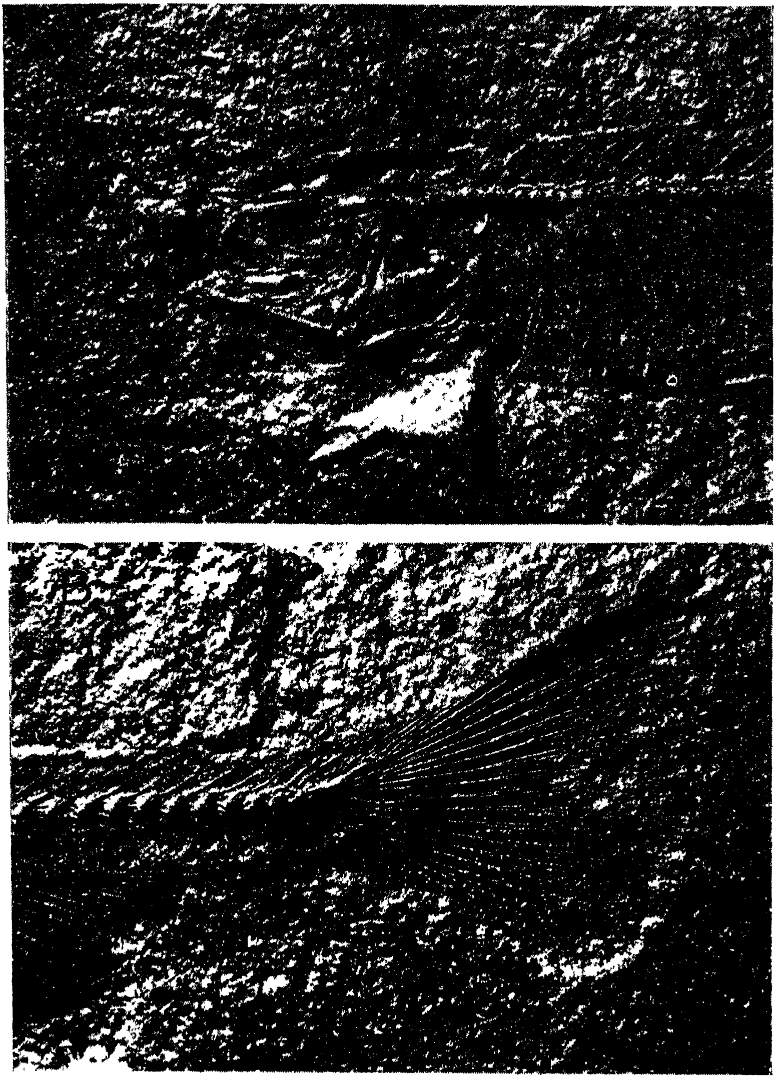

FIG. 2. *Ostariostoma wilseyi.* A. Latex cast of head region, × 5/1. B. Latex cast of caudal fin, × 5/1.

They are located between the fifth and ninth ribs, a position undoubtedly very close to the real one in spite of body compression. The shape and size of the pelvic fins cannot be accurately

determined. Remnants of six rays are indicated. The origin of this fin is about halfway between that of the pectoral and anal.

The dorsal fin is triangular, with the rays progressively decreasing in size anteroposteriorly. There are eight rays, clearly subdivided and jointed for about half their length. The longest ray is equal in length to the distance from the tip of the premaxillary to the posterior border of the opercular. The anterior radials show a moderate expansion, and probably all the radials were widened to some degree.

The elongated anal fin consists of 19 rays. The first two rays are relatively short and are supported by a single radial. The remainder, although not completely preserved, undoubtedly progressively decreased in size anteroposteriorly. The base length of the anal fin is about equal to the depth of the skull at the anterior border of the opercular, or about one-seventh of the total body length. The origin of this fin is well behind the middle of the body and the base of the dorsal fin.

The caudal fin, which is externally homocercal and moderately forked, is internally heterocercal (stegurous). The last vertebra is modified into an elongated, rod-like urostyle, resembling that found in certain of the more generalized isospondyls. There are probably three short epural elements dorsal to the urostyle, the last one being closely applied to the urostyle. About nine expanded, unfused hypurals are indicated. Two vertebrae appear to be involved in the upturned caudal end of the column. Expanded hypurals are present on the last three and possibly the last four vertebrae. The arrangement of the lepidotrichia of the caudal fin permits a natural division into epaxial and hypaxial lobes. This division is also suggested in the external symmetry of the tail and bears no direct relationship to the column, as indicated by Hollister (1936). The dorsal lobe has 19 to 20 raylets plus rays, and the ventral lobe about 17. The rays increase in diameter dorsally and ventrally and are segmented in both lobes.

Scale impressions are absent, suggesting that the skin was naked or, more reasonably, that the scales had either completely disintegrated or were too delicate to leave an impression.

DISCUSSION

Several characters that are of diagnostic value cannot be observed in the specimen of *Ostariostoma*. These include the presence or absence of the mesocoracoid arch, the detailed nature of

the parietal-supraoccipital relationship, the ethnoid area, and the vomer. Others, such as the exact form of the upper jaw and the anterior abdominal vertebrae, cannot be determined with the desired clarity. The number of features that are thus available for ready comparison with the available diagnoses of recognized families and higher categories is seriously reduced.

Ostariostoma has been compared with a number of families in the Isospondyli, Ostariophysi, Iniomi, Haplomi, and Microcyprini. Other orders (or suborders) below the acanthopterygian level have been eliminated from consideration, as no possible affinity appears to be involved. Probably the most important available clue indicative of the evolutionary level represented by *Ostariostoma* is to be found in the internal structure of the caudal fin. Unfortunately this is one of the character complexes that has not been examined thoroughly from a systematic point of view, although there are a number of papers on caudal fin structure.

The skull pattern of *Ostariostoma* shows no definite relationship with that of any family considered. The relatively large premaxillary, strong teeth, forward jaw suspension, and the lack of a suborbital and gular are characters eliminating it from the Leptolepidae. Although the lycopterid skull has not been adequately described, the jaw structure alone in this group bears no resemblance to *O. wilseyi*. This is also true of the elopids with their wide, almost horizontal gape, and in addition the Elopidae have expanded circumorbitals, a relatively small premaxillary (a retained heritage character), a gular plate, and about five times as many branchiostegals.

Both the albulids and the chanids have a forwardly directed suspensorium which was already specialized in its present form in the earliest known Cretaceous members of both families, *Hajulia* and *Prochanos*, respectively. In both, the premaxillary excludes the maxillary from the functional gape which is essentially the case in *Ostariostoma*. The maxillary is relatively smaller than in *Ostariostoma*, and while all known chanids are edentulous, the albulids may have only minute teeth on the jaws. The completely ossified interorbital septum in the Albulidae is at variance with *O. wilseyi*, although it is absent in the chanids. There are also obvious differences in the shape and proportions of the cheek elements between these families and the form from the Livingston formation.

The general form of the skull of *Ostariostoma* bears some resemblance to that of the chirocentrids, particularly in the orientation of the jaws and the relative size of the teeth. This family, however, has a toothed maxillary and a relatively smaller premaxillary (with the exception of *Chirocentrus*). The suspensorium is forwardly directed to only a slight degree in spite of the obliquity of the jaws, and the preopercular is gently curved rather than L-shaped. The Cretaceous representatives have considerably expanded suborbitals, again lacking in *Ostariostoma*.

Relationship of the *Ostariostoma* skull with that of the Clupeidae appears to be ruled out on the basis of tooth development, the teeth of the clupeids being either absent or feeble. Other observable skull characters might fit into this family, although the forward jaw suspension is more extreme and the gape differently oriented than in such types as *Pseudoberyx* and *Chatoessus*, and there is no indication of temporal fenestration. Furthermore, the clupeid opercular has a dorsal extension above the hyomandibular articulation that is lacking in *O. wilseyi*.

The jaw structure and cheek area of the salmonids and osteoglossids with a toothed maxillary and expanded circumorbitals eliminate these families. The extensive mesethmoid (dermethmoid) exposure of the salmonids is likewise apparently missing, and the nasals are relatively smaller than in the osteoglossids, although their exact form or size cannot be determined. The wide, horizontal gape of the Iniomi and related structure of the cheek region go back essentially unmodified to the late Cretaceous along with the complete exclusion of the maxillary from the jaw and exclude any relationship with *Ostariostoma*.

Two families in the Haplomi, the Umbridae and the Dalliidae, have a number of skull characters in common with *O. wilseyi*. These are for the most part related to the similarly displaced suspensorium. There are differences, however, in the shape and relative size of the premaxillary and maxillary and in the opercular elements, as well as in the absence of the infraorbitals in these families.

Resemblance between the skull of *Ostariostoma* and that of most of the cyprinodonts is even more striking, particularly in the form and arrangement of the opercular elements. This is apparently again a case of convergence due to the forward jaw suspension, for the Cyprinodontidae differ in having the maxillary excluded from the jaw margin. Unfortunately virtually none

of the skull characters mentioned by Myers (1931) as diagnostic of this family can be observed.

Within the limits of the Characinidae and the Cyprinidae, most of the observable features of the skull of *Ostariostoma* can be found, including an almost exact duplication of the cheek pattern, the forward jaw suspension, similar premaxillary-maxillary relationship, and relatively robust pointed teeth. There are also other characters in the post-cranial skeleton mentioned below that suggest additional similarity to the more generalized Ostariophysi.

The vertebral column, excluding the last few vertebrae, offers little of diagnostic value. The parapophyses extend laterally very slightly, and it is not possible to determine whether or not they are coalesced with the centra. The rib heads are expanded in a manner suggestive of the characins and cyprinids. The presence or absence of a notochordal canal cannot be observed.

All the families of isospondyls examined (Leptolepidae, Lycopteridae, Elopidae, Albulidae, Chirocentridae, Chanidae, Clupeidae, Salmonidae, and Osteoglossidae) show at least some degree of heterocercy in the adult condition. In *Leptolepis*, Arambourg and Schneegans (1935) have pointed out an interesting transition in the structural series ranging from the early Jurassic *L. coryphaenoides* to the basal Upper Cretaceous *L. congolensis*. This series demonstrates a gradual reduction in the number of vertebrae involved in the upturned axis and in providing attachment for expanded hypural elements. In *L. coryphaenoides* about six vertebrae are involved, while in *congolensis* no more than two. In *Lycoptera middendorffi* (Berg, 1940) and *Lycoptera fragilis* three to four vertebrae enter the upturned axis. The Elopidae have retained the more primitive condition with four vertebrae upturned.

The adult albulids (*Albula*) have a urostyle composed of two centra (Hollister, 1936) which support hypural elements, although as many as four distinct centra (urostyle segments) are involved in the larva of *Albula vulpes*. Instead of the more or less gradual upturning of the posterior end of the column that characterizes the preceding families (*Leptolepis congolensis* representing a known exception), there is a rather abrupt angle in *Albula* between the axis of the column and that of the urostyle elongation, usually about 40 degrees. The Chanidae, including the basal Upper Cretaceous *Parachanos*, the Chirocentridae, and Osteoglossidae,

show a similar condition. The Salmonidae have retained the gradual upturning, evident in *Salmo*, but even more extreme in the Eocene *Thaumaturus* (Voigt, 1934).

Among the Haplomi, the Eocene *Paleoesox* (Voigt, 1934) has three vertebrae involved in the upturned caudal axis. The hypurals are symmetrically arranged, however, on either side of the main vertebral axis. The Esocidae (Berg infers a close relationship of *Paleoesox* with the Umbridae), Dalliidae, and Umbridae have an elongated urostyle but also the symmetrical arrangements of the hypurals.

The reduction of the urostyle to a mere nubbin and the more or less symmetrical expansion of the hypurals on either side of the vertebral axis are characteristic of the Microcyprini, fossil and recent.

The Ostariophysi, while retaining a urostyle, approach a symmetrical arrangement of the hypurals. The haemopophysis of the last vertebra is robust, so that the urostyle and haemopophysis form a sort of symmetrical fork quite unlike the condition in *Ostariostoma*.

This brief survey of caudal fin structure suggests that the situation in *Ostariostoma* is about at the albulid-clupeid level of differentiation. It is clearly more advanced than that found in most leptolepids (with the exception of *L. congolensis*), the lycopterids, or the elopids. Among the chanids, it lacks the symmetry found in *Chanos* in the hypurals but does resemble more closely the condition in *Parachanos* (which Berg believes may be a leptolepid). There is no close resemblance in caudal fin structure to any of the other families considered.[1]

The shoulder girdle offers little more than has already been commented upon in regard to taxonomic characters. The exposure of the coracoid below the cleithrum occurs in varying degrees among the isospondyls as does the narrow supracleithrum. The posttemporal will require additional specimens for its proper interpretation. The elongated triangular form of the pelvic girdle does not resemble closely that of the leptolepids or lycopterids but is similar to the type occurring in the albulids, clupeids, salmonids, and even the cyprinids, except for the absence of a posterior process.

[1] Although the extent and nature of variation in caudal fin structure are unknown, the specimens examined indicate that certain basic patterns are constant for families and possibly lower taxonomic levels.

Dr. Myers (personal communication) has pointed out the remarkable similarity of the dorsal and anal fins to those structures in the characins and cyprinids. This resemblance includes the form of the fin margins, the relative length of the rays, the relative number of rays, as well as the positions of these fins. Fin form, as he states, is a character requiring experience for its proper evaluation, but is nevertheless of value. A survey of dorsal and anal fin form in the Isospondyli, Haplomi, Iniomi, and Microcyprini indicates no close duplication of the combination of characters presented by these fins in *Ostariostoma*.

In regard to the taxonomic position of *Ostariostoma*, the weight of available evidence would appear to indicate the following:

1. *Ostariostoma* cannot be assigned to any known family on the basis of the observed characters. It is therefore placed in a new family, the Ostariostomidae.
2. The family Ostariostomidae is tentatively assigned to the Order Isospondyli, Suborder Clupeoidea. This has been done in spite of the missing or poorly indicated intermuscular bones, the meaning of which is not evident, and because the general level of organization indicates this allocation at the present time rather than any other.
3. As the above description indicates, *Ostariostoma* exhibits many characters shared by the Ostariophysi, particularly the characins. The possibility exists, therefore, that this form is either representative of the ancestral ostariophysial stock, before any extended modification of the anterior vertebrae, or else that it represents a parallel modification in that direction. *Ostariostoma* certainly fills such a role in a more convincing manner than *Lycoptera* which has been considered by some as a possible ancestor of the Ostariophysi (Cockerell, 1925; Hussakof, 1932).

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STUDIES OF PERUVIAN BIRDS. NO. 54 THE FAMILIES CATAMBLYRHYNCHIDAE AND PARULIDAE

BY JOHN T. ZIMMER

I am indebted to Mr. James Bond and Mr. Rodolphe de-Schauensee of the Academy of Natural Sciences of Philadelphia, Dr. Herbert Friedmann of the United States National Museum, and Mr. William H. Phelps of Caracas, Venezuela, for the loan of valuable critical material and for other information of service in the present studies.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Catamblyrhynchus diadema citrinifrons Berlepsch and Stolzmann

Catamblyrhynchus diadema citrinifrons BERLEPSCH AND STOLZMANN, 1896, Proc. Zool. Soc. London, p. 350—Maraynioc, Perú; cotypes in Warsaw Mus., Frankfort Mus., and Amer. Mus. Nat. Hist.

Catamblyrhynchus diadema pallida CARRIKER, 1934 (June 25), Proc. Acad. Nat. Sci. Philadelphia, vol. 86, p. 330—Porculla Pass, Perú; ♀; Acad. Nat. Sci. Philadelphia.

Maraynioc, 2 ♂ (including a cotype of *citrinifrons*), 1 ♀; Palambla, 1 ♂.

In Perú, this species is known from the Temperate and Tropical Zones of the northern, central, and southeastern parts of the country, but it seems not to be common anywhere. Nothing appears to have been recorded concerning its behavior beyond Jelski's observation (cf. Taczanowski, 1886, Ornithologie du

Pérou, vol. 3, p. 25) that it occurs in pairs or in troops of mixed species.

No type was specified in the original description of *citrinifrons* from specimens in the Warsaw Museum and Berlepsch collection (now in Frankfort), so it is presumed that cotypes exist in both collections, although Stolzmann and Domaniewski (Sztolcman and Domaniewski, 1927, Ann. Zool. Mus. Pol. Hist. Nat., vol. 6, p. 168) regard a Warsaw Museum specimen as type. This is negated by one of the original skins in the collection before me which is also marked as type. It is therefore necessary to consider both examples and probably others as cotypes.

The Palambla male, listed above, is a virtual topotype of "*pallida*" but agrees with the central-Peruvian specimens. As pointed out by Hellmayr (1938, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 11, p. 5), the characters ascribed to "*pallida*" are those of immaturity.

Additional Peruvian records are from Pumamarca, Huacapistana, Oconeque, and Porculla Pass.

Parula pitiayumi pacifica Berlepsch and Taczanowski

Parula pitiayumi pacifica Berlepsch and Taczanowski, 1884, Proc. Zool. Soc. London, p. 286—Surupata, Ecuador; ♂; Warsaw Mus.

Alamor, 7 ♂, 4 ♀; Cebollal, 5 ♂; Guainche, 1 ♂, 1 ♀; Paletillas, 6 ♂, 1 ♀, 1 (?); Palambla, 2 ♂, 4 ♀, 1 (?); Seques, 3 ♂, 1 ♀.

There is no apparent differentiation in a long series of specimens from southwestern Colombia to Seques, Perú. An occasional example shows the throat a little lighter yellow than the breast, but the distinction has no geographical significance. Peruvian records are from Túmbez, Lechugal, and Paucal. Records from the Río Pullango, on the boundary between Perú and Ecuador, may be left in the Ecuadorian list as originally recorded.

Parula pitiayumi alarum (Chapman)

Compsothlypis pitiayumi alarum Chapman, 1924 (Nov. 6), Amer. Mus. Novitates, no. 143, p. 2—Chaupe, Perú; ♂; Amer. Mus. Nat. Hist.

Chaupe, 2 ♂ (including type), 4 ♀; Lomo Santo, 2 ♂, 1 (?); Santa Rosa, 1 ♂; Huarandosa, 1 ♀, 1 (?).

There is some variation in the development of the upper wingbar. In most cases this bar is nearly or quite obsolete, but an

occasional example shows a slight development of it. The same is true of eight east-Ecuadorian birds, none of which is likely to be confused with the more northern *elegans*.

Three males and three females in the Rothschild Collection, collected by Goodfellow and Hamilton and labeled as from Baeza, Ecuador, are not so easily determined. They are smaller than most *alarum* and have the upper wing-bar moderately well developed—in one case quite prominent—and the suspicion arises that these examples belong to *pacifica* and came from the western side of the Ecuadorian Andes, not from Baeza. I have had occasion before to comment on the unreliability of Goodfellow and Hamilton's localities.

Three specimens from Chinchao, Perú, that I collected in 1922 (now in the Chicago Natural History Museum) are from near the southern end of the range of *alarum* and show a definite approach toward the characters of *melanogenys* but I think are best referred to *alarum*, as I have already indicated (1930, Field Mus. Nat. Hist., zool. ser., vol. 17, p. 424). On the other hand, two examples now before me, from the Junín region, while similarly intermediate seem to show a little greater resemblance to *melanogenys* under which I have discussed them further.

Records of *alarum* are from Tambillo and Chinchao.

Parula pitiayumi melanogenys (Todd)

Compsothlypis pitiayumi melanogenys TODD, 1924 (July 8), Proc. Biol. Soc. Washington, vol. 27, p. 123—Yungas of Cochabamba, Bolivia; ♂; Carnegie Mus.

Utcuyacu, 1 ♂; Chanchamayo, 1 ♂; Idma, 1 ♀; Chauillay, 1 [♂]; Santa Ana, 1 ♂, 3 ♀; San Miguel, 2 ♂.

These birds agree well with a male and two females from the type locality and a male from Tres Arroyos, Bolivia. Compared with over 150 specimens of *p. pitiayumi* from Brazil, Paraguay, Uruguay, Argentina, and eastern Bolivia they are noticeably darker above and somewhat more deeply colored on the breast, at least in the adult male plumage.

A dissident note is sounded by five birds from Espirito Santo, all of which are darker than *melanogenys*, having the pectoral area as deeply colored as in *roraimae*. One of the males furthermore has strong blackish subterminal areas on the interscapular feathers, giving a spotted appearance to the area—a feature not shown by the other males (two) of this small series. Just

what disposition to make of these birds is a problem that I am not able to solve at the moment. There are four names based on Brazilian birds (*plumbea* Swainson, *brasiliana* Lichtenstein, *venusta* Temminck, and *minuta* Swainson), one of which may be found applicable to the Espirito Santo birds if a good series determines their valid distinction. The proximity of Espirito Santo to Rio de Janeiro, one of the early centers of trade-skin distribution, admits the possibility that the type of one or other of these names may have come from Espirito Santo.

In the discussion of *alarum* I mentioned two birds from the Junín region that are intermediate between *melanogenys* and the more northern form. Neither of these birds has the upper wing-bar so strongly developed as in the best-marked examples of *melanogenys* or more than in the nearest approach in unquestioned *alarum*, and on that basis the specimens are equivocal. Both forms are long winged, and the comparative size is no criterion in this case. One of the birds (Utcuyacu) has the top of the head light enough to fit the extremes of both forms, but that of the other (Chanchamayo) is dark enough to agree best with *melanogenys*, and the relatively dark and dull hue of the interscapular patch is in closer agreement with *melanogenys* than with *alarum*. Consequently I believe these two birds are to be regarded as examples of *melanogenys* at the northern limit of its range.

It is surprising to find typical *pitiayumi* occurring also in the Cochabamba region of Bolivia in very close proximity to the type locality of the present form. Six males and three females from Todos Santos and a female from Mission San Antonio are, however, quite comparable to the rest of the series of *pitiayumi* and easily distinguished from *melanogenys*. Chapman (1925, Auk, vol. 42, p. 205) has already commented on this situation which he ascribes to the difference in elevation of the localities which may be zonal in its effect; *pitiayumi* was found at 1300 feet and *melanogenys* at 3600. If this surmise is true, it must be quite local in its effect, since *pitiayumi* occurs at 5600 feet elevation in eastern Bolivia (Chilón, Santa Cruz) and presumably elsewhere. The Peruvian localities shown by the specimens at hand are at 3500 to 5000 feet which tend to support Chapman's contention that *melanogenys* remains at relatively high elevations.

Additional records of *melanogenys* are from Garita del Sol and Huiro.

Dendroica petechia peruviana Sundevall

[*Dendroica petechia*] g) *peruviana* SUNDEVALL, "June 6, 1869" = 1870, Öfvers. K. Svenska Vetensk.-Akad. Forhandl., vol. 26 (no. 6), p. 609—Callao and Guayaquil; ♂ type from Callao in Stockholm Mus.

I have no Peruvian specimens of this form which is recorded only from Túmbez, Santa Lucia, and Callao in that country, ranging northward in western Ecuador to southwestern Colombia. The original record from Callao is the only evidence supporting the occurrence of this warbler that far south and it may, perhaps, be questionable. It appears to be certain that the type of the allied *D. p. aequatorialis*, collected on the same expedition ("Eugenie" expedition) and said to have come from Guayaquil, actually must have come from Panamá or at least not from Guayaquil. There may therefore be an error in connection with the type of *peruviana* which may, nevertheless, have come from some northern locality on the Peruvian coast, if the "Eugenie" expedition called at any such place. In the meantime, there is no positive proof that "Callao" is untenable as type locality of *peruviana*.

Dendroica petechia amnicola Batchelder

Dendroica aestiva amnicola BATCHELDER, 1918, Proc. New England Zool. Club, vol. 6, p. 82—Curslet, Newfoundland; ♂; C. F. Batchelder coll.

Mouth of the Río Curaray, 2 ♂, 4 ♀.

The identification of wintering examples of the North American forms of this species is extremely difficult. I am not at all confident that my determination of such material is correct. It is possible to arrange some 150 examples of this sort in different groups according to intensity of coloration and prominence of markings, especially those individuals taken in March and April just before they would have begun their northward spring migration. Fall and winter birds, which are in the majority, are the most difficult to arrange.

At any rate, comparison of these more or less arbitrary groups with series of the various northern forms at present recognized has resulted in assigning one Colombian and two Ecuadorian birds to *sonorana;* 17 examples to *brewsteri* (Cayenne, British Guiana, Venezuela, Colombia, and Ecuador); 18 to *morcomi* (Venezuela, Colombia, and Ecuador); 20 to *amnicola* (Cayenne, Venezuela, Colombia, Ecuador, and Perú); and 98 to *aestiva* (Trinidad, Tobago, Cayenne, Surinam, Venezuela, Colombia, and

Ecuador). Some of the supposed *amnicola* may possibly be *rubiginosa,* but I have no certain specimens of that far northwestern form from South America, and very few from Central America.

All six of the Peruvian birds listed above seem best assignable to *amnicola.* Five were taken in November and one in October, and they are therefore in the less definitive seasonal plumage. A good series of late spring birds may be necessary to determine the full extent of the southern wintering range of all these forms, and in view of the uncertainty at present I refrain from listing individual specimens of each, other than the Peruvian examples at hand.

There are Peruvian records also from Iquitos and La Merced, but without the specimens in question it is impossible to say to which form they may properly belong. Since they were both originally recorded as *aestiva,* I have left them under that heading as discussed below.

Dendroica petechia aestiva (Gmelin)

Motacilla aestiva GMELIN, 1789, Systema naturae, vol. 1 (pt. 2), p. 996—based on "Figuier de Canada," Brisson, 1760, Ornithologia sive synopsis methodica . . . , vol. 3, p. 492, pl. 26, fig. 3; etc.

Dendroica aestiva mercedes SZTOLCMAN AND DOMANIEWSKI, 1927, Ann. Zool. Mus. Pol. Hist. Nat., vol. 6, p. 163—La Merced, Chanchamayo, Perú; ♂; Warsaw Mus.

As mentioned in the discussion of *D. p. amnicola,* a record from Iquitos and one from La Merced may possibly belong to *aestiva* as originally cited and in the absence of proof to the contrary may be left with that form. These localities are the most southerly known for the wintering of any migrant form of the species. The La Merced bird was later described as new, but there is nothing in the description to suggest that it was more than a winter visitor from the north which the date of collection (February 26) substantiates.

I have omitted the extensive synonymy of *aestiva,* which would be of little service in the present connection, with the exception of the original reference and that of the description of the supposed new Peruvian subspecies.

Dendroica cerulea (Wilson)

Sylvia cerulea WILSON, 1810, American ornithology, vol. 2, p. 141, pl. 17, fig. 5—Pennsylvania; ♂; Peale's Mus., presumably lost.

Sylvia rara WILSON, 1811, American ornithology, vol. 3, p. 119, pl. 27, fig. 2—banks of the Cumberland River; ♀; Peale's Mus., presumably lost.

Pozuzo, 1 "♀" [= ♂].

A winter visitor from North America. Recorded from Huambo, Pumamarca, Ropaybamba, Amable Maria, Monterico, Chanchamayo, Río Colorado, Huachipa, La Gloria, San Emilio, Idma, and Huaynapata.

I have given in the synonymy only the specific names under which the Peruvian references have appeared.

Dendroica fusca (P. L. S. Müller)

Motacilla fusca P. L. S. MÜLLER, 1776, Natursystem, suppl., p. 175—based on "Figuier étranger," Daubenton, Planches enluminées, pl. 58, fig. 3; "Guyane" = French Guiana.

Motacilla blackburniae GMELIN, 1789, Systema naturae, vol. 1, pt. 2, p. 977—based on "Blackburnian Warbler," Pennant, 1785, Arctic zoology, vol. 2, p. 412; New York.

La Lejia, 5 ♂; San Pedro, 4 ♂, 1 ♀; Chaupe, 2 ♂, 6 ♀, 1 (?); Levanto, 1 ♂; Charapi, 1 ♀; Utcuyacu, 2 ♂, 3 ♀; Chilpes, 1 ♀.

A winter visitor from North America. Other Peruvian records are from Tambillo, Huambo, Chinchao, Huachipa, Auquimarca, and Garita del Sol.

The synonymy given above includes only the specific names under which Peruvian references have appeared.

Dendroica breviunguis (Spix)

Muscicapa striata FORSTER (not *Motacilla striata* Pallas, 1764 = *Muscicapa striata*), 1772, Phil. Trans., vol. 62, art. 29, pp. 406, 428—Severn River = Fort Severn, Hudson Bay; ? type lost.

Alauda (Anthus) breviunguis SPIX, 1824, Avium species novae, . . . Brasiliam, vol. 1, p. 75, pl. "LXXVI–VII," fig. 1—"in Provinciae Parae"; Munich Mus., now lost.

Puerto Indiana, 1 ♀; mouth of Río Curaray, 3 ♂, 3 ♀.

Not previously reported from Perú.

The Puerto Indiana specimen is labeled as having been collected on May 20, an unusually late date for this bird to be found in its winter quarters.

Seiurus noveboracensis noveboracensis (Gmelin)

Motacilla noveboracensis GMELIN, 1789, Systema naturae, vol. 1, pt. 2, p. 958—based on "Fauvette tachetée de la Louisiane," Daubenton, Planches enlu-

minées, pl. 752, fig. 1, and "New York Warbler," Pennant, Arctic zoology, vol. 2, p. 409, and Latham, A general synopsis of birds, vol. 2, pt. 2, p. 958; New York accepted by Hellmayr, 1935.

Mouth of Río Curaray, 1 ♀, 1 (?).

These appear to be the first specimens of the species to be taken in Peruvian territory. Both agree well with the nominate subspecies as represented by autumn birds from the eastern United States.

Geothlypis aequinoctialis velata (Vieillot)

Sylvia velata VIEILLOT, "1807," Histoire naturelle des oiseaux de l'Amérique septentrionale, vol. 2, p. 22, pl. 74—no locality; Rio de Janeiro, Brazil, suggested, Naumburg, 1930; Edinburgh Mus.

Geothlypis canicapilla assimilis BERLEPSCH AND STOLZMANN, 1906, Ornis, vol. 13, p. 75—Chirimoto, Perú; ♂; Frankfort Mus.

Idma, 1 ♂; Santa Ana, 1 ♂, 1 ♀.

I can see no essential difference between these birds and a long series of 120 skins from eastern and central Brazil, Paraguay, northern Argentina, and Bolivia. The bill is at the minimum length shown by the eastern birds but within their range of variation, and the extent of the gray cap likewise shows no distinction. I have no examples from northern Perú in the neighborhood of the type locality of "*assimilis*," and it is just possible that a distinct form may occur there. Berlepsch and Stolzmann, however, had a number of specimens from Santa Ana which they found to be like the Chirimoto bird except for a lighter tone of green on the back (a variable character), and it appears justifiable, therefore, to reject *assimilis* as a synonym of *velata*.

The slight admixture of greenish color in the gray postocular area is likewise occasionally found in east-Brazilian birds, while there is sometimes a grayish tinge apparent in the green of that area in *aequinoctialis aequinoctialis*. This character, therefore, does not appear to be too promising as a feature of "*assimilis*." Possibly the supposed characters of "*assimilis*" are indicative of a trend toward *peruvianus* to the westward of Chirimoto, or even toward *aequinoctialis* which occurs on the south bank of the Amazon as far westward as the left bank of the Rio Madeira whence I have several examples (Santo Antonio de Guajará).

Records of *velata* (under the names *assimilis*, *velata*, *aequinoctialis*, *cucullata*, and *peruviana*) are from Idma, Santa Ana, Maranura, Huiro, and Chirimoto.

Geothlypis aequinoctialis peruviana Taczanowski

Geothlypis aequinoctialis, peruviana TACZANOWSKI, 1884, Ornithologie du Pérou, vol. 1, p. 471—Callacate, Perú; ♂; Warsaw Mus.

Succha, 1 ♂; Viña, 1 ♂.

This form is very like *auricularis*, next to be discussed, but it appears to have a longer wing and tail and a slightly lighter and duller gray cap. I am unable to confirm the shorter bill cited by Hellmayr (1935, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, p. 439, footnote) and indicated by the measurements given by Taczanowski. The two birds in hand have the bill within the range of measurements shown in a good series of *auricularis*.

Other records are from Chusgón and Hacienda Limón.

Geothlypis aequinoctialis auricularis Salvin

Geothlypis auricularis SALVIN, 1883, Proc. Zool. Soc. London, p. 420—Callao, Perú; ♂; British Mus.

Lima, 5 ♂, 1 ♀, 1 (?); Vitarte, 3 ♂; Huaral, 4 ♂, 3 ♀; Paletillas, 1 "♂" [= ♀]; Trujillo, 4 ♂, 1 ♀.

Some variation is shown in the width of the black frontal band and the extent of black on the sides of the head, but there is no geographical correlation evident. Eight west-Ecuadorian birds agree well with the Peruvian specimens.

Other records are from Chepén, Guadalupe, and Túmbez.

Wilsonia canadensis (Linnaeus)

[*Muscicapa*] *canadensis* LINNAEUS, 1766, Systema naturae, ed. 12, vol. 1, p. 327—based on "Le Gobe-mouche cendré de Canada," Brisson; Canada; type presumably lost.

Lagarto, 1 ♂; La Merced, 1 (?); Chaupe, 3 ♂; Uchco, 1 ♂; Río Negro, west of Moyobamba, 1 ♀.

A migrant from North America. Additional Peruvian records are from Tambillo, Huambo, Paucal, La Gloria, Chinchao, Vista Alegre, Huachipa, Amable Maria, Monterico, and Idma.

I have omitted the list of synonyms since all Peruvian records are under the name *canadensis* and no supposed Peruvian form has been proposed.

[**Setophaga ruticilla** (Linnaeus)

There seems to have been no clear basis for the inclusion of Perú in the winter range of this species by Sharpe (1885, Catalogue

of the birds in the British Museum, vol. 10, p. 413), an inadvertence that led Taczanowski (1886, Ornithologie du Pérou, vol. 3, p. 507) to add it also to his account. It does range southward to northern Ecuador and may possibly be found on occasion straggling even farther and reaching Perú, but at present there is no evidence of it.]

Myioborus miniatus verticalis (D'Orbigny and Lafresnaye)

Setophaga verticalis D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., vol. 7, cl. 2, "Synopsis avium," p. 50—Ayupaya, Bolivia; Paris Mus.

This subspecies shows a rather gradual diminution of the white on the outer rectrices from Bolivia northward to northern Perú and southeastern Ecuador, on the Amazonian side of the Andes. There is no place where definition is very marked, and I am unable to separate the northern part of the population from the southern with any degree of confidence. Some of the more northern examples are very close to *ballux*, and examples of the latter form from northern Ecuador often show a trend toward *verticalis* with the preponderance of evidence pointing toward *ballux*. Still farther north, of course, *ballux* is more firmly entrenched, and there is no question of its validity as distinct from *verticalis*. It crosses all three ranges in Colombia and even comes southward into northwestern Ecuador, on the Pacific slope. Like most of the other South American forms, it is not uniform throughout but cannot be satisfactorily broken up.

I refer all Peruvian birds, therefore, except those from the Pacific side of the Andes in the northernmost part of the country, to *verticalis*, while realizing that the population is geographically variable *inter se*, though without stabilized subdivisions. The western population will be discussed a little later.

The most curious fact in the study of *verticalis* has been the apparent impossibility of separating specimens from Mt. Duida and Mt. Roraima, Venezuela, and Twek-quay, British Guiana, from this geographically distant form. They are too deeply yellow on the belly for *pallidiventris* and have too much white on the tail for *ballux* and may be matched with various examples of *verticalis* in both particulars. Admittedly the number of specimens is small (six), and perhaps a greater series might show some distinctions not apparent in the material at hand, but Mr. W. H. Phelps advises me that he made the same disposition of the south-

Venezuelan birds in his collection in Caracas, and agreement with *verticalis* is thus substantiated.

Peruvian records assignable to *verticalis*, not listed with the material examined, are from Huaynapata, San Antonio (near Cosñipata), Potrero, La Gloria, Garita del Sol, Monterico, Vitoc, Ropaybamba, Chirimoto, Tambillo, and Tabaconas.

The separation of *ballux* from *pallidiventris* (Wetmore and Phelps, 1944, Proc. Biol. Soc. Washington, vol. 57, p. 11) left *pallidiventris* with a divided range, since no trenchant characters were found by which to recognize any further divisions, although the birds from Santa Marta, Colombia, were found to be slightly different in dorsal and ventral coloration. The material at hand from Santa Marta shows the slightly lighter dorsal coloration mentioned by the authors of *ballux* and in addition presents a noticeable difference in the development of white on the tail feathers. The subspecific separation of the Santa Marta birds appears justifiable. The description follows:

Myioborus miniatus sanctaemartae, new subspecies

Type: From Las Nubes, Santa Marta, Colombia. No. 70525, American Museum of Natural History. Adult of unrecorded sex collected December 10, 1898, by Grace H. Hull.

Diagnosis: Similar to *M. m. pallidiventris* of northeastern Venezuela in respect to the paleness of the yellow coloration of the lower under parts but differing by the reduction of white on the outer tail-feathers; blackish base of inner web of outermost rectrix always somewhat exposed beyond the tips of the under tail-coverts; dark inner margin of subexternal feather reaching farther distad on average; white tip of fourth quill (from middle) shorter and frequently not projected distad along outer web farther than the corresponding portion of the inner web, making a wedge-shaped patch; general dorsal coloration averaging paler gray.

Range: Presumably restricted to the Santa Marta Mountains of northern Colombia.

Description of Type: Upper parts largely Slate Gray; forehead with short dusky shaft-streaks; center of crown and occiput occupied by a patch of Burnt Sienna × Chestnut, most of the feathers with narrow gray tips; upper tail-coverts blackish with fine gray tips; side of head Slate Gray including malar region; center of throat black; breast and abdomen Lemon

Chrome, slightly deeper on upper breast; sides of breast gray; extreme lateral margin of flanks gray with some olive tinge; longer under tail-coverts white; shorter ones yellow. Remiges dusky, with outer margins gray, narrowest on primaries but obsolete on outermost feather; upper wing-coverts Slate Gray with a fine whitish dot at tips of greater series; under wing-coverts dull whitish with a darker area near carpal margin; inner margins of remiges inconspicuously lighter than the rest of the inner webs. Tail with three middle pairs of rectrices blackish, with narrow white tips on the second and third pairs; fourth pair blackish, with a cuneate terminal patch of white about 14 mm. in length, with the apex of the triangle on the inner web; fifth pair with a broad blackish basal portion and diagonal white tip crossing the shaft between 25 and 27 mm. from the tip and ending 10 mm. from the tip on the inner web and 28 mm. from the tip on the outer web; outermost pair largely white, with the blackish basal area reaching within 11 mm. of the base on the outer web and 34 mm. from the base on the inner web where the black is exposed well beyond the tips of the under tail-coverts. Bill (in dried skin) black; feet dark brown. Wing, 62 mm.; tail, 59; exposed culmen, 7.9; culmen from base, 11.9; tarsus, 18.

Remarks: Ten specimens from Santa Marta compared with 28 Venezuelan examples of *pallidiventris* show such consistent distinction in respect to the amount of white on the tail that the separation of the present form is definitely indicated. The geographical isolation of the Santa Marta Mountains from the area in Venezuela where *pallidiventris* occurs offers further weight to the distinction.

The characteristic cuneate tip on the fourth pair of rectrices (third from outside) of *sanctaemartae* is not shown in any of the examples of *pallidiventris*, and, although some examples of *sanctaemartae* have an extension of the pale tip basad along the outer web of the feather, it does not reach so far. Measurements taken of both series show the following figures:

In *pallidiventris*, from the base of the feather to the white tip, the distance on the outer web is 14–28 mm. (average, 21.4); on the inner web, 23–28 (average, 32.2). In *sanctaemartae:* outer web, 29–44 (average, 37.8); inner web, 40–50 (average, 44.4). In the series at hand there is no overlap.

The exposure of the dark basal inner margins of the outermost rectrices is not a constant criterion, for although this marking

seems to be exposed consistently in *sanctaemartae*, it is sometimes concealed and sometimes exposed (though less obviously) in *pallidiventris*.

The amount of white on the tip of the third pair of rectrices (fourth from outside) is less constantly different, but only one example of *sanctaemartae* shows more than a narrow terminal margin, and in this specimen the white area is only 3 to 3.5 mm. long. In *pallidiventris*, on the other hand, 24 of 29 adults have a pronounced patch or elongate stripe on these feathers. The character is thus of good correlative value.

Returning to a consideration of the southwest-Ecuadorian and northwest-Peruvian birds, I would note their similarity to *pallidiventris* in respect to the pattern of white markings on the rectrices, as well as in other features. In other coloration these birds most nearly resemble *pallidiventris* but show some approximation to *ballux*, although their range is not intermediate in any sense. They form a fairly consistent population with a combination of characters of their own, which appears to entitle them to separate recognition and I propose to name them as follows:

Myioborus miniatus subsimilis, new subspecies

TYPE: From Alamor, Perú; altitude 4450 feet; No. 172201, American Museum of Natural History. Adult male collected August 22, 1921, by George K. Cherrie and Geoffrey Gill. Original no. 23651.

DIAGNOSIS: Similar to *M. m. pallidiventris* of northeastern Venezuela but back slightly duller gray; forehead and sides of crown with less frequent development of black centers on the feathers; chin and throat more broadly and more deeply black; sides of breast darker gray; yellow of breast and belly averaging a little deeper yellow though not so deep as in *ballux* or *verticalis*. Further differs from *ballux* by the lesser development of black on the forehead and sides of the crown, and from *verticalis* by the greater amount of black on the throat and the lesser extent of white on the tail.

RANGE: Southwestern Ecuador and northwestern Perú, on the Pacific slope of the Western Andes.

DESCRIPTION OF TYPE: Upper parts largely Deep Neutral Gray; center of crown and occiput with a broad patch of light Chestnut, paler at the bases of the feathers; forehead and sides of the crown with little development of dusky shaft-markings;

upper tail-coverts blackish with dark gray margins; sides of head somewhat blackish; malar region gray; chin and throat broadly deep black; breast and belly Lemon Chrome, deeper on the breast; sides of breast Blackish Slate; flanks slaty, merging into the yellow of the belly; under tail-coverts white with a slight yellowish tinge. Remiges blackish brown with outer margins narrowly dark gray, somewhat whitish on the outermost primary distally; inner secondaries with a narrow white terminal margin on the inner web (not constant in the series); upper wing-coverts blackish gray with faintly paler dots at the tips of the greater series; under wing-coverts white with a dark patch near the carpal margin which is white with a slight yellowish tinge; inner margins of remiges near Pallid Mouse Gray. Tail with two median rectrices blackish with fine white terminal points; third pair with a white patch on the tip of the outer web, about 10 mm. long, and withdrawn from the outer margin for the basal two-thirds of its length; inner web with only a narrow white terminal margin; fourth pair blackish with the outer web white to within 19 mm. of the base and with a diagonal patch of white on the inner web reaching the shaft 33 mm. from the base and on the inner margin 53 mm. from the base; fifth pair mostly white, with the dark basal area about 9 mm. from the base on the outer web and 25 mm. from the base at the shaft on the inner web and 40 mm. from the base at the inner margin; sixth pair similar, with the blackish basal area extending 7 mm. from the base on the outer web and 17 mm. from the base along the shaft on the inner web and 25 mm. on the inner margin. Bill (in dried skin) black; feet blackish brown. Wing, 63 mm.; tail, 63; exposed culmen, 8; culmen from base, 10; tarsus, 18.

REMARKS: Chapman (1926, Bull. Amer. Mus. Nat. Hist., vol. 55, p. 597) commented on the paler ventral coloration of the birds of western Ecuador in comparison with those from the eastern side of the Andes, and their lesser amount of black on the sides of the crown and the forehead, but did not venture to name them. The eastern birds, however, he referred to his *pallidiventris*, in which he also included birds from northern Perú which I believe cannot be clearly separated from *verticalis*. Southeast-Ecuadorian birds are also best assigned to *verticalis*, as I have stated earlier, while the north-Ecuadorian birds, from both sides of the Andes, belong to *ballux*. It is only in the southwestern part of Ecuador and northwestern Perú that the paler ventral

coloration and the relative reduction of black on the forehead and sides of the crown become well established.

There are no earlier Peruvian records that are assignable to *subsimilis*.

SPECIMENS EXAMINED

M. miniatus pallidiventris.—
VENEZUELA:
Quebrada Seca, 1 (?) (type);
(Cumaná, Los Palmales, Río Neveri, Santa Ana Valley, Montaña de Guácharo, Cotiza, Galipán, Cumbre de Valencia, El Limón, Mt. Bucarito, La Trinidad, El Guácharo, Colonia Tovar, Silla de Caracas, and La Latal), 10 ♂, 10 ♀, 9 (?).
M. m. ballux.—
VENEZUELA:
(Mérida, Escorial, Culata, Valle, and Hechisera), 10 ♂, 2 ♀, 6 (?).
COLOMBIA:
(San Antonio, near San Agustín, Las Lomitas, east of Palmira, Aguadita, El Roble, Tenasuca, Barro Blanco, Anolaima, Fusagasugá, Panamá (above Pacho), Antioquia, Subia, Santa Elena, Paramillo trail, La Candela, Andalucia, Cali, Gallera, La Sierra, Río Toché, Primavera, Salento, Cerro Munchique, Popayán, Mari Lopez, La Palma, Torné, and Bogotá), 38 ♂, 30 ♀, 13 (?).
PANAMÁ:
Tacarcuna, 3 ♂, 2 ♀.
ECUADOR:
(Lower Sumaco, upper Sumaco, Oyacachi, Papallacta, San José, below San José, Baeza, Puente del Río Quijos, Mindo, Pichincha, Valle de Cumbaya, Mocha, and Ibarra), 21 ♂, 17 ♀, 4 (?).
M. m. sanctaemartae.—
COLOMBIA:
Santa Marta, Las Nubes, 6 (?) (including type);
El Líbano, 1 (?);
Valparaiso, 1 ♂, 1 ♀, 1 (?).
M. m. subsimilis.—
ECUADOR:
Guachanamá, 1 ♂;
Punta Santa Ana, 1 (?);
Zaruma, 2 ♂; 4 (?);
San Bartolo, 5 ♂;
Celica, 1 ♂, 3 ♀;
El Chiral, 2 ♂, 1 "?♀";
Cocó, 1 ♂, 2 ♀.
PERÚ:
Alamor, 6 ♂ (including type), 4 ♀, 1 (?);
Cebollal, 1 ♂;
La Puente, 1 ♂;
Palambla, 1 ♂, 3 ♀, 2 (?);

Seques, 3 ♂, 2 ♀, 1 (?).

M. m. verticalis.—

ECUADOR:

Zamora, 1 "? ♀";
Sabanilla, 3 ♂;
Loja, 4 ♂, 1 ♀.

PERÚ:

Lomo Santo, 1 ♂, 1 ♀, 1 (?);
San Felipe, 1 ♀, 1 (?);
Huancabamba, 1 ♂, 1 ♀, 1 (?);
San Ignacio, 1 ♂;
Chaupe, 3 ♂, 1 ♀;
Uchco, 1 ♀;
Río Seco, 1 ♂, 1 ♀;
Hacienda Limón, 1 ♂[1]; 2 ♀[1];
Nuevo Loreto, 1 (?);
Huachipa, 1 ♂[1], 1 ♀[1];
Utcuyacu, 1 ♂, 1 ♀;
San Ramón, 1 ♂;
Idma, 2 ♂, 2 ♀;
San Miguel Bridge, 1 ♀;
San Miguel, 1 ♀, 1 (?);
Huiro, 1 ♂;
Río Inambari, 3 ♂, 1 ♀;
Santo Domingo, 3 ♂, 2 ♀;
Inca Mine, 1 ♂.

BOLIVIA:

Roquefalda, 1 ♂, 1 "♀";
Locotal, 1 ♀;
Yungas, Cochabamba, 6 ♂, 2 ♀;
Pulque, 1 "♀".

VENEZUELA:

Mt. Duida, Agüita, 2 ♀;
Mt. Roraima, Arabupú, 1 ♂, 1 ♀.

BRITISH GUIANA:

Twek-quay, 1 ♀, 1 (?).

Myioborus melanocephalus griseonuchus CHAPMAN

Myioborus bairdi griseonuchus CHAPMAN, 1927, Amer. Mus. Novitates, no. 250, p. 5—Taulis, northeast of Pacasmayo, Perú; ♂; Amer. Mus. Nat. Hist.

This form differs from *ruficoronatus* (including *bairdi*) of Ecuador by several characters, not all of which have been published. None of them is perfectly constant, but they are sufficiently so to justify the recognition of the subspecies. The black nuchal band is never strongly developed as in *ruficoronatus*,

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[1] Specimens in Chicago Natural History Museum.

although there is sometimes a very fine black line in place of it or even, in one specimen at hand, a broader area that is dark at the tips of the feathers but not solidly black. In *ruficoronatus* there are in the series at hand only two birds without nuchal black; in almost all of the specimens the area is quite broadly black.

The sides of the face in *griseonuchus* are inclined to be less deeply black than in *ruficoronatus*, though not always so, and the third pair of rectrices from the outside more consistently show a more or less extensive white terminal patch, sometimes carried well basad, but these features can be matched in some examples of *ruficoronatus*. Also, the yellow eye-ring is almost always broken next to the lores in *griseonuchus* and almost always complete in *ruficoronatus*, although sometimes very narrow.

The range of *griseonuchus* appears to be quite restricted to the Western Andes of northern Perú and, although several birds from southern Ecuador (Loja, Salvias, and Taraguacocha) show approach toward its characters in one or more respects, they are closer to *ruficoronatus* where they undoubtedly belong. Peruvian records from Chota and Cutervo appear to belong to *griseonuchus*.

The study has involved the puzzling relationship of the bird described as "*Setophaga ruficoronata*" by Kaup ("1851" [=Oct., 1852], Proc. Zool. Soc. London, p. 49—no locality). DeSchauensee (1946, Notulae Naturae, no. 167, p. 7) has considered it to be no more than one extreme of individual variation of "*bairdi*" (*Setophaga bairdi* Salvin, 1878, Ibis, ser. 4, vol. 2, p. 317, pl. 8, fig. 1—Sical, Ecuador), and in view of the priority of the name, he has used *ruficoronatus* as the subspecific term with *bairdi* as a synonym.

I have two specimens of the *ruficoronatus* plumage from Oyacachi, Ecuador, and a good series of the much commoner "*bairdi*" plumage, including two birds also from Oyacachi. There is a surprising amount of individual variation in the "*bairdi*" assortment, especially in regard to the markings on the head. The dark extreme shows the forehead and anterior crown solidly black and the sides of the crown similarly broadly marked. The other extreme (still short of the "*ruficoronatus*" plumage) has the forehead and anterior crown yellow with black tips, the sides of the crown rather narrowly black, and the black patch on the lower part of the lores reduced or even absent. The two "*ruficoronatus*" specimens have the forehead and anterior part of the crown

clearer yellow, although in one specimen there are small black tips on some of the feathers, the black stripe above the yellow superciliary is withdrawn from above the anterior part of the orbit, and the black in the malar region and on the lores is slight. In one specimen, the yellow of the forehead has advanced posteriad above the black stripe that still remains on the sides of the occiput as a forward extension of the black nuchal band.

These various characters are combined in different ways so that there are nearly as many degrees of intermediacy between extremes as there are specimens in the series. It appears, therefore, that it is not possible to maintain *ruficoronatus* and *bairdi* as distinct species nor yet, in view of the occurrence of both types of plumage in single localities, to regard them as subspecies. The full extreme of typical *ruficoronatus* occurs only in northernmost Ecuador and southernmost Colombia, but there are approaches to it throughout the range of "*bairdi.*" Northward from the range of the species, there occurs the closely allied *ornatus* with its two subspecies, *o. ornatus* and *o. chrysops*. The extreme characters of *ruficoronatus* strongly suggest those of the *ornatus* group, and an occasional specimen of *o. chrysops* shows a noticeable patch of rufous in the center of the crown, strongly suggesting *ruficoronatus*. It is not impossible, therefore, that the puzzling specimens of one sort and another may represent intergrades or even hybrids between the two groups, but much more material will be necessary before an adequate solution is reached. If the type of *ruficoronatus* actually came from near Cali as claimed by various authors, beginning with Salvin (1878, Ibis, p. 316), the ranges of that form and *chrysops* must overlap. No confirmation has appeared in the field work of recent collectors.

At present, therefore, I accept deSchauensee's arrangement and adopt *ruficoronatus* as the subspecific term for the Ecuadorian and extreme southwest-Colombian population including the birds heretofore separated as "*bairdi.*"

This discussion was undertaken largely because of the inclusion of Perú in the range of *ruficoronatus* by Sharpe (1885, Catalogue of the birds in the British Museum, vol. 10, p. 425). No exact locality, reference to an earlier citation of such, or specimen in the collection from Perú is given, and I can conclude only that "Perú" was cited in error.

Additional Peruvian records that appear to be assignable to

griseonuchus are from Chota and Cutervo, on the eastern side of the Western Andes.

Birds from across the Marañón, in the Central Andes of northern Perú, have been assigned by authors to the central-Peruvian form, *melanocephalus*, but there are certain positive distinctions that I believe warrant the separation of these birds, as described below:

Myioborus melanocephalus malaris, new subspecies

TYPE: From La Lejia, north of Chachapoyas, Perú; altitude about 9000 feet. No. 235067, American Museum of Natural History. Adult male collected February 28, 1925, by Harry Watkins; original no. 8845.

DIAGNOSIS: Nearest to *M. m. melanocephalus* of central-southern Perú, but differs by having the yellow eye-ring separated from the yellow throat by a complete blackish malar stripe that connects the lores and the auriculars; yellow eye-ring broadly interrupted in front of the eye by the incursion of the blackish loral spot.

RANGE: Central Andes of northern Perú in the general neighborhood of Chachapoyas.

DESCRIPTION OF TYPE: Anterior part of forehead and broad eye-ring (interrupted anteriorly) Lemon Chrome × Light Cadmium; posterior part of forehead, crown, and occiput glossy black; hind neck and mantle Deep Neutral Gray; rump a little lighter; upper tail-coverts blackish. Lores blackish, interrupting the yellow eye-ring, and continued as a rather broad black malar stripe under the eye-ring to the blackish auriculars and upward behind the circumocular ring to connect with the hinder part of crown; most of under parts Lemon Chrome × Light Cadmium, deepest on the throat and chest, paler on the lower belly; under tail-coverts much paler, near Marguerite Yellow; sides of breast dusky gray adjoining the mantle, and flanks with gray stripes; thighs gray. Exterior surface of wings gray like the mantle; inner margins of remiges dull whitish; under wing-coverts whitish, sometimes yellowish distally; carpal margin yellow with a grayish area at the base of the primaries. Tail with outermost pair of rectrices white except for a grayish area at base, reaching out a third of the way distad on the inner web; next pair with basal gray more extensive and with a trace of blackish on outer margin near the tip; third pair largely blackish, with a white stripe along

the shaft on the outer web, invading the inner web about a third of the way to the tip; remainder of tail black. Bill (in dried skin) blackish; feet dark brown. Wing, 71 mm.; tail, 67; exposed culmen, 9; culmen from base, 13; tarsus, 19.

REMARKS: Females similar but averaging smaller. Wing, 65–65.5 (average 65.2); tail, 61.5–64 (average, 62.8); males, wing, 65–72.5 (average, 69.1); tail, 63–67.5 (average, 65.2).

Young birds have the whole upper parts and sides of the head brownish gray, the throat dull buff, and the breast buffy brown.

The uninterrupted blackish malar stripe is found in *griseonuchus* but not in *melanocephalus*, and *malaris* thus shows one of the important characters indicating relationship between the two first-mentioned forms. I called attention to this distinction from *melanocephalus* in an earlier paper (1930, Field Mus. Nat. Hist., zool. ser., vol. 17, p. 426). At the same time I noted a specimen from Molinopampa with traces of brown on the basal margins of the crown feathers. This same marking is shown by one of the males at hand from La Lejia, emphasizing the suggested intermediacy.

The only locality of record assignable to *malaris*, from which I have not seen material, is Tamiapampa.

Myioborus melanocephalus melanocephalus (Tschudi)

S[etophaga] melanocephala TSCHUDI, 1844 (May), Arch. Naturgesch., 10th year, vol. 1, p. 276—Perú; I propose Maraynioc, Junín, as type locality; Neuchâtel Mus.

The birds from central Perú have the yellow eye-ring connected with the yellow throat by a broad vertical bar, sometimes occupying the whole terminal part of the feathers concerned but sometimes with a narrow dark terminal margin beyond the yellow. The ventral coloration is about as deep yellow as in *malaris* and deeper than in most *griseonuchus*. The color of this area is deeper than in *bolivianus*, and the extent of white on the third pair of rectrices (from the outside) is somewhat greater, although there is no sharp definition in this latter respect.

Birds from the Urubamba Valley show the strongest development of the subocular yellow bar of any segment of the population. The character is of variable occurrence in *bolivianus*.

Records assignable to *melanocephalus* are from Garita del Sol, Vitoc, Pumamarca, Higos, Ropaybamba, and Hacienda Huarapa (Huánuco). Records from various localities in extreme south-

eastern Perú are discussed under *bolivianus* to which I believe they belong.

Myioborus melanocephalus bolivianus Chapman

Myioborus melanocephalus bolivianus CHAPMAN, 1919 (Dec. 31), Proc. Biol. Soc. Washington, vol. 32, p. 365—Incachaca, Bolivia; ♂; Amer. Mus. Nat. Hist.

I believe that the birds from southeastern Perú are better assigned to *bolivianus* than to *melanocephalus*, although they are, as Chapman indicated, somewhat intermediate in respect to the amount of white on the third outer pair of rectrices. In the depth of yellow on the under parts (lighter than in *melanocephalus*), they are definitely closer to *bolivianus*, and this feature is less variable than is the amount of white on the tail although subject also to some variation.

Chapman (*loc. cit.*) reported *bolivianus* to have a shorter wing and longer tail than *melanocephalus*, but the average difference is not very pronounced and the overlap is great. In these particulars, the southeast-Peruvian series is somewhat anomalous since it has both wing and tail shorter than in either the Bolivian or central Peruvian specimens, again on average. The following figures show the measurements of the birds examined:

		WING	TAIL
Bolivia	6 ♂	65.5–70.5 (67.6)	63.0–68.5 (66.1)
Southeastern Perú	9 ♂	65.0–69.0 (65.5)	59.0–64.0 (61.5)
Central Perú	15 ♂	62.5–73.0 (69.4)	58.0–68.5 (64.7)
[Central Perú	14 ♂	68.0–73.0 (69.2)	63.0–68.5 (64.5)]
Bolivia	13 ♀	63.0–66.5 (64.8)	61.0–67.0 (63.3)
Southeastern Perú	3 ♀	61.0–65.0 (62.3)	58.0–63.0 (60.3)
Central Perú	10 ♀	62.0–70.0 (66.5)	63.0–66.5 (64.1)
[Central Perú	11 ♀	62.0–70.0 (66.2)	58.0–66.5 (63.6)]

Included in the central Peruvian series of males is a single bird with unusually small measurements which may be a wrongly sexed female. I have given in square brackets the range of measurements and the averages with this specimen transferred to the series of females, but although this transfer alters the minimum dimensions ascribed to the two sexes of *melanocephalus*, it does not significantly alter the averages or the belief that the difference of size in the two forms is not positive enough to form a very useful criterion of distinction. I am unable to find any noticeable difference in the length of the bill which was believed

by Chapman to be longer in *bolivianus* than in the central Peruvian form.

Records that I believe should be placed with *bolivianus* are from Marcapata and "Chachupata" (=Ccachupata or Cachupata).

SPECIMENS EXAMINED

M. m. ruficoronatus.—
  ECUADOR:
    (Canzacota, above Milligalli, Papallacta, Asilan, Salvias, above Baeza, Gualea, Tambillo, Cayambe, Yanacocha, Pichincha, Corazón, Loja, Taraguacocha, upper Sumaco, Puente Onda, Zuñac, lower Río Sardinas, Urbina, and Oyacachi), 24 ♂, 26 ♀, 9 (?).
M. m. griseonuchus.—
  PERÚ:
    Taulis, 3 ♂ (including type), 2 ♀;
    Chugur, 4 ♂, 2 ♀;
    El Tambo, 1 (?).
M. m. malaris.—
  PERÚ:
    La Lejia, 2 ♂ (including type), 3 ♀, 2 (?);
    San Pedro, 3 ♂, 1 ♀;
    Chachapoyas, 1 ♂, 1 ♀;
    Leimebamba, 2 ♂;
    Molinopampa, 1 ♂[1], 1 ♀[1], 1 (?)[1].
M. m. melanocephalus.—
  PERÚ:
    Mountains above Huánuco, 1 ♂[1], 1 ♀[1];
    above Panao, 2 ♂[1], 2 ♀[1];
    Maraynioc, 1 ♂;
    Rumicruz, 4 ♂, 2 ♀;
    Chilpes, 4 ♂, 2 ♀;
    Huacapistana, 1 ♂;
    Chanchamayo, 1 ♂;
    Santa Rita, Urubamba, 2 ♂;
    Torontoy, 2 ♀, 1 ?♀;
    San Miguel, 1 ♂, 1 ♀, 1 ?♀, 2 (?).
M. m. bolivianus.—
  PERÚ:
    Santo Domingo, 6 ♂, 2 ♀;
    Inca Mine, 2 ♂, 1 ♀;
    Oconeque, 1 ♂.
  BOLIVIA:
    Río Aceramarca, 1 ♀;
    Cocapata, 2 ♂;
    Incachaca, 5 ♂, 13 ♀.

[1] Specimens in Chicago Natural History Museum.

M. o. ornatus.—
COLOMBIA:
(Chipaque, El Dosena, Subia, El Roble, Choachi, El Piñon, Palo Hueco, Anolaima, "Bogotá", and unspecified), 4 ♂, 4 ♀, 14 (?).
M. o. chrysops.—
COLOMBIA:
(Cocal, Valle de las Papas, west of Popayán, above Salento, LaGuneta, Antioquia, El Eden, Santa Elena, and "Bogotá"), 9 ♂, 5 ♀, 5 (?).

Basileuterus nigro-cristatus (Lafresnaye)

Trichas nigro-cristatus LAFRESNAYE, 1840, Rev. Zool., vol. 3, p. 230—Santa Fé de Bogotá, Colombia; Mus. Comp. Zoöl.

Myiodioctes meridionalis PELZELN, 1882, Verhandl. Zool. Bot. Gesellsch. Wien, vol. 32, p. 446—Ecuador; Vienna Mus.

Basileuterus nigrivertex SALVIN, 1895, Novitates Zool., vol. 2, p. 3—Cajabamba, Succha, and Huamachuco, Perú; Brit. Mus.

Succha, 1 (?); Cajabamba, 1 ♂, 2 ♀; Huamachuco, 1 ♀; San Pedro, 2 ♀; Chugur, 2 ♂, 2 ♀; Taulis, 1 ♀; El Tambo, 1 ♀.

I find it impossible to maintain *nigrivertex* as a distinct subspecies in spite of the fact that it shows a certain extreme divergence from the average characteristics of more northern populations. The Peruvian birds tend to have the black of the cap carried a little less far posteriad, and apparently never have so elongate an area as some of the more northern birds, but the latter are far from uniform in this respect and frequently match the Peruvian birds.

The supposedly lighter or brighter olive of the back in "*nigrivertex*" is matched by many birds from Ecuador, Colombia, and Perú and does not hold as a valid criterion for distinction. The lengths of wing and tail have some geographical significance, but it is difficult to make satisfactory use of the figures. The Ecuadorian series shows an average of shorter wing and tail than the Colombian birds, but there is considerable overlapping. The Peruvian specimens have an average of longer wing and tail than the Colombian population, but again there is much overlapping. Between the Peruvian and the Ecuadorian series, there is a little overlapping in wing length but apparently definite distinction in respect to tail length, but neither the Ecuadorian nor Peruvian birds can be clearly distinguished from Colombian ones although at opposite ends of the scale of variation from each other. Venezuelan birds are not significantly different from the Colombian. A few figures will show the trends.

		Males		Females	
		Wing	Tail	Wing	Tail
Venezuela	8♂, 8♀	60.5–63.5	56.5–64.5	54.0–63.0	56.0–60.0
Colombia	6♂, 7♀	61.0–66.0	58.0–66.0	57.0–62.5	55.0–63.0
Ecuador	12♂, 2♀	56.0–64.0	51.5–60 0	56.0–57.0	54.0–56.0
Perú	9♂, 8♀	63.0–69.5	63.5–68.0	58.0–62 5	57 0–66.0

In view of the pattern of distribution shown by these measurements, I believe it is best to consider the species as not clearly divisible into subspecies. The still more southern form *euophrys*, considered by Hellmayr and others as belonging to this specific group, is not a conspecies of *nigro-cristatus* but belongs with *luteoviridis*, under which it is discussed in detail.

The Succha specimen (without sex) and one of the Cajabamba females are inscribed "Cotype" [of *nigrivertex*], but their exact status in this regard is questionable. No specimen without sex is listed in the original account, where the single Succha example is noted as a male. The specimen at hand, therefore, is doubtfully even a paratype, although the Cajabamba female may be such. The type itself is noted by Hellmayr (1935, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, p. 478) as being in the British Museum.

Additional records of *nigro-cristatus* are from Cullcui (specimens examined), Chachapoyas (sight record), and Cutervo. I have seen examples also in the Academy of Natural Sciences of Philadelphia from Palambla, Leimebamba, and Cochabamba (Dept. Libertad).

Basileuterus luteoviridis striaticeps (Cabanis)

Myiothlypis striaticeps Cabanis, 1873, Jour. f. Ornith., vol. 21, p. 316—Maraynioc, Perú; ♂; Berlin Mus.

Basileuterus luteoviridis superciliaris Chapman, 1919 (Dec. 31), Proc. Biol. Soc. Washington, vol. 32, p. 265—above Torontoy, Urubamba Cañon, Perú; ♂; U. S. Natl. Mus.

Specimens from the northern part of Perú show no approach toward typical *luteoviridis*, being even a little clearer olive above than the average bird from the Junín region. The difference is very slight and not constant, and no subspecific distinction is evident.

The case of "*superciliaris*" presents a somewhat similar problem. Todd (1929, Proc. U. S. Natl. Mus., vol. 74, art. 7, p. 48) was unable to recognize it, while Hellmayr (1935, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, p. 480) considered it distinguishable.

I have examined the four known Urubamba Valley examples of the species, including the type of "*superciliaris*," and am inclined to agree with Todd. Two of the specimens that are noticeably browner than central and north-Peruvian examples of *striaticeps* are not fully adult, showing, among other features, a trace of tawny edges near the tips of the greater upper wing-coverts, not found in adults. The type and one other specimen are adult and may be matched in the series of *striaticeps*, although the average color of the latter is darker, but not greener, than that of the two adult Urubamba birds. In any case, there is no assurance of clear distinction, and until a larger series of Urubamba birds is available, it seems best to consider "*superciliaris*" as a synonym of *striaticeps*.

It should be noted in passing that two males from Almaguer, Colombia, recorded by Chapman (1917, Bull. Amer. Mus. Nat. Hist., vol. 36, p. 550) as *luteoviridis*, to which deSchauensee (1946, Notulae Naturae, no. 167, p. 8) also refers Almaguer examples, are somewhat closer to *quindianus* (deSchauensee, *loc. cit.*) than to the nominate form. The yellow of the under parts is less intense than in *luteoviridis*, the flanks are a little lighter olive brown, and the superciliary stripe is weaker and less deeply and clearly yellow. They are not so extreme in these respects as Laguneta and Toché (Tolima) specimens of *quindianus* but are intermediate between them and *luteoviridis*; but I believe they are better associated with *quindianus* than with the typical subspecies, an assignment that furthermore is in good accord with the geographical position of Almaguer.

Basileuterus luteoviridis euophrys Sclater and Salvin

Basileuterus euophrys Sclater and Salvin, 1876, Proc. Zool. Soc. London, p. 352—Tilotilo, Prov. Yungas, Bolivia; ♂, ♀ cotypes in Brit. Mus.

This form was considered by Hellmayr (1924, Arch. Naturgesch., div. A, vol. 90, no. 2, p. 157) as conspecific with *nigrocristatus*, but I fail to trace the supposed relationship. *Nigrocristatus* has various points of distinction. The black loral patch is small, barely reaching the base of the bill, whereas in *euophrys* it extends at least halfway from the gape to the nostril and sometimes rounds the anterior end of the superciliary stripe to meet the central coronal stripe. The yellow superciliary stripe is in immediate contact with the upper border of the orbit, whereas in *euophrys* the blackish loral patch extends posteriad in a narrow

line over the orbit to meet the dusky postocular space. There is a prominent yellowish lunule just below the eye which is diffuse or absent in *euophrys*. There is a semi-elongate black crest that is medial, whereas the blackish coronal feathers of *euophrys* are lateral. The bill is flatter and with a little straighter culmen than in *euophrys*. The feet of *nigro-cristatus* are usually paler and the rictal bristles less strongly developed.

In all these respects, *euophrys* agrees exactly with the members of the *luteoviridis* group. It has the dusky lateral crown stripes more prominent than in the other members of the group, and forming a broad V-shaped pattern of black or dusky olive, though apparently always with a median olive stripe on the occiput and most of the crown. The superciliary stripe is wider than in *luteoviridis luteoviridis* but about as in *l. striaticeps*, although a little more pronounced posteriorly. The dusky postocular patch is more strongly developed and often more deeply blackish, as are the lores, than in *striaticeps* where, however, it is stronger than in *luteoviridis*. These distinctions are all modifications of the same basic pattern and do not necessitate the decided saltation demanded by consideration of *euophrys* as a conspecies of *nigro-cristatus*.

There are no earlier published records of *euophrys* from Perú, although my specimen from Limbani was collected (by Ockenden) in 1904. As with *striaticeps* and *luteoviridis*, there is some variation in the clarity of the olive coloration of the back, and three of the Peruvian birds at hand are a little browner in tone than the fourth specimen which is like the Bolivian examples. Likewise the greatest amount of black on the head is found in one of the Bolivian birds and the least in one of the Peruvian, but the rest are irregularly distributed in that respect. I see no reason to attempt to separate the Peruvian birds from the Bolivian.

SPECIMENS EXAMINED

B. l. luteoviridis.—
COLOMBIA:
(Almaguer, Subia, Choachi, Anolaima, Fomeque, "Bogotá"), 1 ♂, 1 ♀, 5 [? ♂], 4 [? ♀], 2 (?).
ECUADOR:
(Upper Sumaco, above Baeza, Zuñac, Tambillo), 3 ♂, 3 ♀, 2 [? ♂], 1 [? ♀], 1 (?).
B. l. quindianus.—
COLOMBIA:
Laguneta, 1 ♂;
Almaguer, 2 ♂;

Toché, Tolima, 1 ? ♂[1], 2 ♀[1], 1 ? ♀[1].
B. l. richardsoni.—
COLOMBIA:
Coast range west of Popayán, 1 ♂ (type), 3 ♀, 1 (?).
B. l. striaticeps.—
PERÚ:
La Lejia, 1 ♂, 1 ♀;
Leimebamba, 1 ♂[1], 2 ♀[1];
Utcubamba, 1 ♂[1];
Compan, 1 [? ♀];
Maraynioc, 3 ♂, 3 ♀;
Rumicruz, 1 ♂, 1 ♀;
Huacapistana, 5 ♀[1];
Torontoy, 1 ♂, 1 ♂[2] (type), 1 ♀[2],
Cedrobamba, 1 ♀.
B. l. euophrys.—
PERÚ:
Limbani, 1 ♀;
below Limbani, 1 ♀;
Oconeque, 1 ♂[1], 1 ♀[1].
BOLIVIA:
Sandillani, 1 ♂, 1 (?);
Unduavi, 2 (?).

Basileuterus signatus signatus Berlepsch and Stolzmann

Basileuterus signatus BERLEPSCH AND STOLZMANN, 1906 (Sept.), Ornis, vol. 13, p. 74—part; Idma, Urubamba Valley; ♀; Warsaw Mus.

Six birds from the Junín region of central Perú suggest the possibility of distinguishing another form from that area. Five of them are slightly grayer olive in tone on the upper parts and three of them are paler yellow on the under side, but two of the five are hardly different below while the sixth bird is like Urubamba specimens in all particulars. I hesitate, therefore, to do more at this juncture than point out the characters noted and await additional material from Junín before attempting to establish a new subspecies.

Additional records of *signatus* are from Idma and Garita del Sol.

Basileuterus signatus flavovirens Todd

Basileuterus signatus flavovirens TODD, 1929, Proc. U. S. Natl. Mus., vol. 74, art. 7, p. 45—Incachaca, Bolivia; ♂; Carnegie Mus.

[1] Specimens in Academy of Natural Sciences of Philadelphia.
[2] Specimens in the United States National Museum, Washington, D. C.

Birds from southeastern Perú are referable to the Bolivian form which has somewhat brighter or more citrine olive upper parts and deeper yellow superciliary stripes and under parts than typical *signatus*.

Additional records are from the Marcapata Valley and "Chuhuasi" (=Uruhasi).

The characters distinguishing *signatus* and *flavovirens* from *flaveolus* of southern and eastern Brazil and northern Venezuela are almost all of such a nature that specific union is strongly suggested. *Flaveolus* has a rather consistently longer bill and reaches a somewhat greater extreme in lengths of wing and tail (although specimens may be matched in these respects in both groups), and in addition it has the general coloration, including that of the bill and feet, lighter and clearer than in the *signatus* group. The dark lateral crown stripes are even suggested in some examples of *flaveolus*, although in most cases they are quite lacking. The general style of coloration and the general proportions are not notably different in the two groups. It is to be noted, however, that *flaveolus* has a somewhat different wing formula, with the ninth (outermost) primary subequal to the second, and the eighth longer than the fourth, sometimes longer than the fifth. In the *signatus* group, on the other hand, the ninth primary is the shortest of all, and the eighth is subequal to the second, rarely to the third. One specimen of *flaveolus* from Galipán, Venezuela, approaches *signatus* in this particular.

The distribution of the two groups is also significant, for while *flaveolus* is found for the most part at lower elevations than *signatus*, it is largely on the more elevated portions of the terrain such as the Matto Grosso plateau and does not descend into the Amazonian plain. Thus while I shall not propose full specific union at present, I believe that the relationship of *flaveolus* and *signatus* should be recognized as quite close.

If *flaveolus* were an inhabitant of the southern Temperate Zone, it might be postulated that the longer wing-tip and lengthened outer primaries indicated a migratory behavior and that the records from extreme northern Venezuela concerned wintering individuals, but the northern specimens now at hand were taken in January, February, August, and September, while every month in the year is represented in the southern collections. The curiously interrupted distribution of *flaveolus* is, therefore, hardly to be explained on that basis. In this connection it is interesting

to call attention to two specimens recorded herewith from Frechal, Rio Surumú, northern Brazil—the first, I believe, to help to bridge the gap between northern Venezuela and the Province of Maranhão, eastern Brazil. A male from Río Zulia, west of Cúcuta, Colombia, presented by Brother Nicéforo Maria, furnishes a northwestern extension of range and the first record of *flaveolus* from Colombia.

SPECIMENS EXAMINED

B. s. signatus.—
PERÚ:
Chilpes, 1 ♂;
Rumicruz, 3 ♂;
Huacapistana, 1 ♂[1], 1 ♀;
Torontoy, 1 ♂, 1 ♀;
Santa Rita, 1 ♂, 3 ♀;
San Miguel, 2 ♂, 2 ♀.
B. s. flavovirens.—
PERÚ:
Marcapata, 1 ♀;
Oconeque, 1 ♂, 1 ♂[1];
Santo Domingo, 3 ♂, 1 ♀;
Inca Mine, 1 ♂, 1 ♀.
BOLIVIA:
Incachaca, 2 ♂, 1 ♀, 1 ?♀, 1 (?);
Yungas, 1 (?);
Río Aceramarca, 1 (?).
B. flaveolus.—
BOLIVIA:
"Woods," Province of Sara, 1 ♂.
BRAZIL:
Matto Grosso (Chapada, Urucum, Utiarity, Descalvados), 24 ♂, 9 ♀, 2 (?);
Ceará (São Pedro do Cariry, Lavras), 1 ♂, 1 (?);
Bahia (Sincorá, Bahia, "Bahia"), 4 ♂, 1 ?♂, 2 ♀, 4 (?);
Goiaz, Rio Araguaya, 1 ♀;
Piauhy (Therezina, Bello Horizonte, Patos, Gilbues, Urussuhy, Parnaguá, Correntes), 1 ♂, 4 ♀, 2 (?);
Pernambuco (Garanhuns, Brejão), 1 ♂, 1 ?♀;
Maranhão (São João dos Patos, As Mangueras, São Luiz), 2 ♂, 1 ♀, 2 (?);
Rio Surumú, Frechal, 1 ♂, 1 ♀.
PARAGUAY:
Zanja Morotí, 3 ♂, 1 ♀;
Fort Wheeler, 1 ♀.
VENEZUELA:
Las Quiguas, 1 ♂;

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[1] Specimens in the Academy of Natural Sciences of Philadelphia.

El Limón, 2 ♂;
Mt. Bucarito, Tocuyo, 1 (?);
Galipán, 1 ♀.
COLOMBIA:
Río Zulia, west of Cúcuta, 1 ♂.

Basileuterus bivittatus bivittatus (D'Orbigny and Lafresnaye)

M[uscicapa] bivittata D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., vol. 7, cl. 2, p. 51—part; Yungas, rep. Boliviana [= Carcuata (= Circuata)], Yungas of La Paz; ♂; Paris Mus.

The characters noted by Hellmayr (1935, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, p. 487, footnote) as peculiar to southeast-Peruvian birds do not hold true in a larger series from that area, expecially in comparison with birds from the La Paz and Cochabamba regions of Bolivia, the former of which are topotypical of *bivittatus*. They have more significance when comparison is made with examples from southern Bolivia and northern Argentina where the population is recognizably distinguishable, as is described below. Peruvian birds appear to be inseparable from true *bivittatus*.

The typical form of the species thus ranges from southeastern Perú through the Yungas of La Paz to the neighborhood of Cochabamba, Bolivia, without any obvious distinctions. The localities are all on the northern slope of the Andean range that extends eastward in this region, in Upper Tropical Zone forests.

Additional Peruvian records are from Huaynapata and Callanga.

Basileuterus bivittatus argentinae, new subspecies

TYPE: From Ledesma, Province of Jujuy, Argentina; altitude 520 meters. No. 505681, American Museum of Natural History. Adult male collected July 7, 1906, by Luis Dinelli; original no. 4124.

DIAGNOSIS: Similar to *B. bivittatus bivittatus* of Cochabamba and La Paz regions of Bolivia and southeastern Perú, but differing by lighter dorsal coloration, lighter sides of the head, sides, and flanks, more prominent yellow supraloral stripe, somewhat less deeply black lateral crown-stripes, and paler rufescent central crown-patch which is more frequently strongly yellow.

RANGE: Northwestern Argentina in the Provinces of Jujuy and Salta, probably to Tucumán, extending northward into

adjacent parts of southeastern Bolivia as far as southwestern Santa Cruz.

DESCRIPTION OF TYPE: Center of the top of the head occupied by a patch of rufous feathers, near Mars Yellow, with brighter yellow bases and fine grayish olive tips; this patch bordered laterally by a broad sooty blackish stripe on either side, converging at the base of the bill and extending posteriad to the sides of the nape; feathers of these stripes finely tipped with olive; center of nape and most of the back dark Citrine, becoming lighter and brighter, near Citrine, on the uropygium and upper tail-coverts. Lores with a triangular dusky patch in front of the eye surmounted by a prominent yellow stripe reaching broadly to the orbit and continued narrowly on the upper eyelid above which the superciliary stripe of dark Citrine (with faint traces of yellow flecks) continues over the auriculars; a small indistinct postocular line present; lower eyelid feathers yellow; malar region and auriculars Citrine with yellower shaft streaks. Under parts largely Lemon Chrome, becoming tinged with light Citrine on the sides of the breast and light brownish Citrine on the flanks. Remiges brown, with exposed outer margins and the margins of the upper wing-coverts like the back; under wing-coverts pale yellow except for a brownish patch at base of primaries; inner margins of remiges narrowly whitish except toward tips of outer primaries and on the tertials. Tail Citrine, brighter on outer margins. Bill (in dried skin) blackish brown; feet pale brownish. Wing, 68 mm.; tail, 60; exposed culmen, 10; culmen from base, 14.5; tarsus, 23.

REMARKS: Females much like the males in coloration, perhaps with the dark lateral crown-stripes averaging duller and less blackish; size smaller—wing, 58.8–65 (male, 64–70.3); tail, 53.2–57 (male, 56–64).

Although the birds listed below from Samaipata, Monos, and Bermejo, Santa Cruz, are from localities in the Amazon drainage, they are just as definitely separable from *bivittatus* (also from the Amazon drainage) as are specimens from southern Bolivia, in the Río Pilcomayo drainage. As was found to be the case with *Chlorospingus ophthalmicus* (cf. Amer. Mus. Novitates, 1947, no. 1367, p. 3), the position of the localities in the great bend of the Río Grande is influenced more by the fact that they are on the dry southern slope of this eastern extension of the Andes than that the rivers of that area eventually, after making a broad sweep,

turn northward and find their way into the Río Mamoré and eventually the Amazon. The northern slope—in the range of *bivittatus*—is much more humid.

The Bolivian specimens in the series at hand that I refer to *argentinae* are a little more greenish olive above and less buffy on the under parts than the Argentine examples and have the dark lateral crown-stripes a little deeper black, although they still resemble the Argentine examples more than they do typical *bivittatus*. The Argentine specimens are a few years older in point of collection than the Bolivian, but it is uncertain that the difference is due to postmortem change; I can find no similar change apparent in specimens of the allied *B. b. roraimae* of even greater age. Moreover, one of the Argentine birds was collected on the Río Bermejo, Province of Salta, and two of the Bolivian series were taken on the same river a little higher upstream. They show the distinctions mentioned, but subspecific separation in this case would be very unlikely. I prefer therefore to assign the southeast-Bolivian specimens to *argentinae* rather than to attempt further subdivision.

SPECIMENS EXAMINED

B. b. bivittatus.—
PERÚ:
Río Inambari, 1 ♂, 1 ♀, 1 (?);
La Oroya, 2 ♂, 1 ♀, 2 ♂[1], 2 ♀[1];
La Pampa, 1 ♂[1].
BOLIVIA:
Calabatea, La Paz, 3 ♂[1];
Yungas, Cochabamba, 1 ♀;
Palmar, Cochabamba, 3 ♂[1], 1 ♀[1].
B. b. argentinae.—
BOLIVIA:
Monos, Santa Cruz, 2 ♂;
Bermejo, Santa Cruz, 4 ♂, 2 ♀;
Samaipata, 2 ♂[1];
Lagunillas, 1 ♂[1];
Río Azero, Chuquisaca, 1 ♂[1];
Bermejo, Tarija, 1♂[1], 1 ♀[1];
Entre Ríos, 1 ♀[1];
Río Lipeo, 4 ♂[1], 2 ♀[1], 1 (?)[1].
ARGENTINA:
Ledesma, Jujuy, 3 ♂ (including type), 3 ♀;
Río Bermejo, Salta, 1 ♂;

[1] Specimens in Academy of Natural Sciences of Philadelphia.

Yacuiba ("S. Bolivia" = Salta, Argentina), 1 ♂.

B. b. roraimae.—

VENEZUELA:

Roraima, 2 ♂, 4 ♀, 1 (?);

Arabupu, 12 ♂, 6 ♀;

Paulo, 2 ♂;

Mt. Auyan-tepui, 1 ♀, 2 (?);

Mt. Duida (Agüita, Laterite Valley, Primer Pico, Cumbre de Cabeceras), 5 ♂, 3 ♀, 1 (?).

BRITISH GUIANA:

Twek-quay, 1 ♂;

Bartica, 1 ♀[1].

Basileuterus chrysogaster chrysogaster (Tschudi)

S[etophaga] chrysogaster TSCHUDI, 1844 (May), Arch. Naturgesch., 10th year, vol. 1, p. 276—Perú; Chanchamayo suggested by Hellmayr, 1920; Mus. Neuchâtel.

Basileuterus diachlorus CABANIS, 1873, Jour. f. Ornith., vol. 21, p. 316—Amable Maria, Perú; ♂; Berlin Mus.

The question of relationship between the *chrysogaster* group and the *bivittatus* group is not easy to answer. The two groups have not been taken at the same exact localities, although both occur in the southeastern part of Perú, and there appears to be no altitudinal segregation.

The two groups are very much alike in general appearance. While the Bolivian and north-Argentine members of *bivittatus* have greenish tails and *c. chrysogaster* has a grayish brown one (except on the margins), the southeast-Peruvian population of *bivittatus* has a noticeable tinge of brown and *chrysogaster chlorophrys* of western Ecuador again has a greenish tail.

Likewise, *c. chrysogaster* has a definite yellow superciliary stripe carried over the auriculars, while *c. chlorophrys* agrees with *bivittatus* in all parts of its range in having the yellow line over the lores but not over the orbit and auriculars. Again, *c. chrysogaster* has a broad, if diffuse, yellow subocular lunule, whereas *bivittatus* has a smaller but sharper yellow mark in that area and *c. chrysophrys* has little or no yellow below the eye.

The dark lateral crown stripes in *c. chrysogaster* are less blackish than in the Peruvian and north-Bolivian populations of *bivittatus*, being like those of the north-Argentine birds, while *c. chlorophrys* has these stripes again deep in tone.

In shape of bill, *c. chrysogaster* and *c. chlorophrys* agree and

[1] Specimen in collection of New York Zoological Society.

differ from *bivittatus*, having this member relatively short and thick, with the culmen more noticeably decurved toward the tip than in *bivittatus*. It is also lighter in color, less blackish than in *bivittatus*. In lengths of wing, tail, bill, and feet, *chrysogaster* and *chlorophrys* agree well together, being smaller, on average, than *bivittatus*. *Chlorophrys* has an even shorter tail than *c. chrysogaster*.

In these characters, therefore, it is possible to find justification for putting *chrysogaster* and *bivittatus* in a single specific group, or to keep them specifically distinct, depending on the evaluation of the similarities and dissimilarities. I believe, however, that the general proportions and the configuration of the bill present the stronger argument for recognizing two species, each of which shows much the same range of variation in respect to details of coloration, with extremes of one sort or another differently presented.

We are still left with the curious hiatus that exists between the range of *c. chrysogaster* in central and southeastern Perú and that of *c. chlorophrys* in western Ecuador, and I can find no likely candidate for the position of connectant form among the birds that occupy the northern part of Perú.

Additional records of *chrysogaster* are from Amable Maria, Monterico, and Yahuarmayo.

SPECIMENS EXAMINED

B. c. chrysogaster.—
 Perú:
  Chanchamayo, 1 ♀;
  La Merced, 1 ♂;
  Tulumayo, 3 ♂, 2 ♀;
  La Pampa, 2 ♀;
  Astillero, 1 ♀.
B. c. chlorophrys.—
 Ecuador:
  Lita, 2 ♂;
  Paramba, 3 ♂;
  Cachiyacu, 1 ♀;
  Chimbo, 1 ♀.
 Colombia:
  Buenavista, Nariño, 1 ♂, 1 (?).

Basileuterus tristriatus tristriatus (Tschudi)

M[yiodioctes] tristriatus Tschudi, 1844 (May), Arch. Naturgesch., 10th year, vol. 1, p. 283—Perú; Valley of Vitoc suggested by Hellmayr, 1935; Mus. Neuchâtel.

There appear to be no recognizable distinctions among the birds of the eastern face of the Andes from the Río Zamora in southern Ecuador to the Urubamba Valley in Perú. The population is quite definitely brighter in color than that of the more northern *baezae* and has more white on the throat, but extreme examples in both series are very similar.

Additional records are from Ropaybamba and Auquimarca, Junín. The statement of Tschudi (1845, Fauna Peruana, Aves, p. 194) that he found this bird at San Pedro, near Lurin, on the coast of Perú was certainly an error as has been pointed out by earlier authors.

Chapman (1924, Amer. Mus. Novitates, no. 143, p. 6) and Todd (1929, Proc. U. S. Natl. Mus., vol. 74, p. 62) comment on a specimen from La Frijolera, Colombia, that appears to be indistinguishable from the present Peruvian form, although both authors considered it a mutant of a local Colombian subspecies—Chapman of *auricularis* and Todd of *daedalus* (which Chapman did not recognize). Although this conclusion is not impossible, it may be that a series of specimens from the region of La Frijolera would show a resident population with the characters of this unique example. Such a series has not been available to any student of the group but should be secured and studied before final disposition of the case is made.

Beyond the Urubamba Valley, in southeastern Perú, the population is noticeably different and has been assigned by authors to the north central Bolivian form, *punctipectus*, although differences have been noted. With somewhat more material than has been available to earlier workers, I believe that there is enough distinction presented to warrant the recognition of a new form from this region. The description follows:

Basileuterus tristriatus inconspicuus, new subspecies

Type: From Inca Mine, southeastern Perú. No. 74071, American Museum of Natural History. Adult male collected August 3, 1900, by H. H. Keays; original no. 81.

Diagnosis: Similar to *B. t. punctipectus* of the Cochabamba region of Bolivia but differing by more uniform under parts, with the spotting on the breast and throat duller and less obvious or obsolete; throat averaging whiter, less yellowish.

Range: Subtropical Zone of the Inambari Valley of south-

eastern Perú and possibly adjacent areas, extending eastward into northwestern Bolivia north of La Paz.

Description of Type: Center of crown occupied by a broad stripe of Ivory Yellow, becoming more whitish on the occiput and nape; bordering this median stripe on each side is a broad blackish stripe expanding posteriorly; upper part of lores broadly whitish, continued somewhat more narrowly over the orbit in a superciliary stripe that becomes tinged with grayish at the posterior end; lower part of lores occupied by a blackish patch; a broad postocular stripe blackish, spreading across the middle of the auricular area and anteriorly below a large, white, subocular lunule; posterior part of auriculars dull whitish, forming a vertical stripe connecting with the throat. Back Citrine Drab × Yellowish Olive; throat dull whitish, with a narrow dusky submalar stripe at the sides; breast and belly medially Ivory Yellow × Colonial Buff with indistinct traces of pale Grayish Olive specks at the tips of the feathers, more obvious on sides; flanks near Grayish Olive; under tail-coverts with the longer feathers tinged with light Isabella Color. Wings dark brown, with the outer margins of the remiges Yellowish Olive × Light Yellowish Olive; exposed portions of upper wing-coverts like the back; under wing-coverts yellowish white; inner margins of remiges narrowly dull whitish. Tail brown, with outer margins Light Brownish Olive toward the base. Bill (in dried skin) with maxilla brown, mandible pale brownish; feet brown. Wing, 62 mm.; tail, 52.5; exposed culmen, 9; culmen from base, 12.8; tarsus, 20.

Remarks: Females like the males in color but with shorter wing and tail (wing, 53–58.6; tail, 48–51.5; males, wing, 57–64; tail, 50–57.5).

Seven Peruvian specimens show rather more than average distinction from topotypical *punctipectus* from the Cochabamba region of Bolivia. In fact, only two of the Peruvian birds have the spotting on the breast pronounced enough to suggest *punctipectus* at its least-spotted extreme, far from the average of the Cochabamba form. The upper parts average a little duller olive also, but the character is not constant enough to be of much service. Other Peruvian records are from Huaynapata and Río Cadena.

A little farther east, in the region north of La Paz, Bolivia, there is less certainty as to the proper assignment of the material. Nine specimens certainly from this area are, as a series, interme-

diate between the southeast-Peruvian specimens and the Cochabamba region birds although closer to the former. Two of the nine birds have as much spotting on the breast as the more weakly marked Cochabamba specimens, and the others are very lightly marked, agreeing well with the Peruvian series. Three additional birds from the Rusby collection are uncertain owing to the lack of adequate and reliable data. One of these is marked as collected at Mapiri but is dark, with moderately heavy pectoral markings and a strongly yellow throat. The elevation is given at 4000 feet which is puzzling since the well-known locality of that name north of La Paz is much higher and off the route followed, as nearly as I can ascertain, by the expedition in question. This bird is the nearest to *punctipectus* of the three mentioned and is matched in respect to the pectoral spotting by a single example from Roquefalda, itself more lightly marked than most of the rest of the Cochabamba series.

The other two Rusby birds have no exact localities but may have come from the La Paz region. One has an unspotted breast like one extreme of the Peruvian series (quite unmatched in Cochabamba birds), while the other is like the more heavily spotted Peruvian and La Paz examples.

The La Paz examples have the general tone of the under parts a little stronger yellow than is shown by Peruvian birds at hand, but this is the only character that approximates the features of *punctipectus* as compared with *inconspicuus*. As noted above, the closer affinity appears to be with the Peruvian form.

In eastern Bolivia, a different combination of characters apparently exists, although the material to demonstrate it is limited. Three examples from the Department of Santa Cruz, kindly lent by Mr. deSchauensee of the Academy of Natural Sciences of Philadelphia, agree in characters that differentiate them from all the 41 examples of *inconspicuus* and *punctipectus* at hand. Through the kindness of Mr. deSchauensee I am enabled to describe the form, as follows:

Basileuterus tristriatus canens, new subspecies

TYPE: From Samaipata, Department of Santa Cruz, Bolivia; altitude 5500 feet. No. 133676, Academy of Natural Sciences of Philadelphia. Adult male collected November 3, 1937, by M. A. Carriker, Jr.; original no. 16407.

DIAGNOSIS: Similar to *B. t. punctipectus* of the region north

of Cochabamba, Bolivia, but back more grayish olive, median crown stripe more whitish, less tinged with yellow or buff; lateral crown stripes more deeply black; under parts whiter, less yellowish; breast similarly, though slightly less heavily, spotted with dusky.

RANGE: Known only from the type locality, but probably occurs in adjacent areas on the southeastern slope of the Bolivian Andes.

DESCRIPTION OF TYPE: General pattern as described for *B. t. inconspicuus*, but central crown stripe paler and duller, near Olive Buff; superciliaries whiter; back near Deep Grayish Olive; exposed outer margins of remiges and rectrices a little brighter, near Citrine-Drab. Throat whitish, tinged with Marguerite Yellow; middle of belly Marguerite Yellow × Primrose Yellow; under tail-coverts paler; breast a little deeper, marked with conspicuous dusky spots (not so sharply defined as in *punctipectus*), continued anteriad on the throat; flanks near Light Yellowish Olive. Wing, 64 mm.; tail, 57; exposed culmen, 9; culmen from base, 12.8; tarsus, 20.5.

REMARKS: Female like the male but somewhat smaller. Wing, 58; tail, 52; exposed culmen, 9; culmen from base, 12.8; tarsus, 20.

A second male is whiter on the under parts and the central crown stripe than the type or the single female and is thus even more distinct from *punctipectus* than they are, although all three resemble one another more than they do the Cochabamba form.

SPECIMENS EXAMINED

B. t. melanotis.—
COSTA RICA:
Aquinares, 2 ♂;
Quebradilla de Azahar, 2 ♀;
Azahar de Cartago, 1 (?).
PANAMÁ:
Boquete, 1 ♂, 1 ♀;
Chiriquí, 1 ♂, 1 (?).
B. t. chitrensis.—
PANAMÁ:
Chitrá, 8 ♂ (including type), 2 ?♂, 7 ♀, 1 (?);
Santa Fé, 1 ♂, 1 ?♂.
B. t. daedalus.—
COLOMBIA:
Salento, 1 ♂, 1 (?);

Miraflores, 3 ♂, 1 ♀, 1 (?);
Las Lomitas, 2 ♀;
San Antonio, Cauca, 6 ♂, 1 ♀;
Gallera, 1 ♂, 1 (?);
El Roble, Quindio Andes, 2 ♂, 1 ♀;
Cocal, 1 ♂;
Cerro Munchique, 1 ♀;
"Bogotá," 1 (?).

ECUADOR:
Gualea, 2 ♂, 1 (?);
Paramba, 2 ♂, 1 ♀.

B. t. subsp.?
COLOMBIA:
La Frijolera, 1 ♂.

B. t. auricularis.—
COLOMBIA:
La Candela, 1 ♂, 1 ♀;
La Palma, 1 ♂;
Aguadita, 1 ♂;
near San Agustín, 1 ♂.

B. t. meridanus.—
VENEZUELA:
El Valle, 1 ♂;
Mt. Bucarito, 1 (?);
El Limón, 1 ♂;
Cumbre de Valencia, 1 ♂;
"Caripe" (loc. err.), 2 (?).

B. t. bessereri.—
VENEZUELA:
Cotiza, 1 ♂;
Cerro de Avila, 1 ♂;
Silla de Caracas; 1 ♂;
Galipán, 1 ♂, 1 ♀;
"Venezuela," 2 ♂, 1 ♀, 1 (?).

B. t. baezae.—
ECUADOR:
Baeza, 3 ♂ (including type), 2 ♀;
lower Sumaco, 3 ♂, 3 ♀;
San José de Sumaco, 1 ♂;
Macas region, 1 (?).

B. t. tristriatus.—
ECUADOR:
Sabanilla, 1 ♂, 1 ♀.
PERÚ:
Chaupe, 2 ♂, 1 (?);
Lomo Santo, 1 ♂;
Santa Rosa, 1 ♂;
Uchco, 1 ♂, 2 ♀;
Nuevo Loreto, 1 (?);

Chinchao, 2 ♂[1], 1 ♀[1];
Utcuyacu, 1 ♂, 3 ♀;
Chilpes, 1 ♂, 2 ♀, 2 (?);
Pan de Azúcar, Río Tarma, 1 ♀;
Idma, 2 ♂, 1 ♀.

B. t. inconspicuus.—
PERÚ:
Inca Mine, 2 ♂ (including type);
Santo Domingo, 1 ♂, 1 ♀, 1 ♂[2], 1 (?)[2];
La Oroya, 1 ♂[2].
BOLIVIA:
Nequejahuira, 1 ♂, 1 (?);
"Bolivia," 1 (?);
Calabatea, La Paz, 1 ♂[2], 1 ♀[2];
Sandillani, 2 ♂[2], 3 ♀[2].

B. t. punctipectus.—
BOLIVIA:
Locotal, 2 ♂, 1 ♀;
Incachaca, 1 ♂, 1 ♀, 1 ♂[2], 1 ♀[2];
Roquefalda, 1 ♂, 2 (?);
Yungas, Cochabamba, 3 ♂, 1 ♀, 1 (?)[2];
San Jacinto, 1 ♀[2], 1 (?)[2];
Palmar, 1 ♀[2];
"Mapiri," 1 (?);
"Bolivia," 1 (?).

B. t. canens.—
BOLIVIA:
Samaipata, Santa Cruz, 2 ♂ (including type)[2], 1 ♀[2].

Basileuterus trifasciatus trifasciatus Taczanowski

Basileuterus trifasciatus TACZANOWSKI, 1880, Proc. Zool. Soc. London, p. 191 —Callacate, Perú; ♂; type formerly in Warsaw Mus., now lost.

This form, with its conspecies *nitidior* of southwestern Ecuador, is rather certainly closely allied to the wide-ranging species *culicivorus*, the nearest geographical representative of which is found in western Colombia. The general proportions and the pattern of the head are very similar in both groups and strongly suggest close relationship. Nevertheless, there is a little break in the continuity of characters, and it may be as well to maintain specific separation until a better degree of affinity is firmly established. Many members of the genus share a variety of characters in common, and relationships may be suggested that are too distant to establish specific unity. In the present case, however, there

Specimens in Chicago Natural History Museum.
Specimens in Academy of Natural Sciences of Philadelphia.

is no other species evident to which *trifasciatus* appears to bear a closer affinity than *culicivorus*.

Additional records are from Callacate and Paucal.

The examination of the *culicivorus* group in the present connection has indicated that some revision is necessary in that species. The assignment of east-Colombian birds to the Trinidad form while at the same time the west-Colombian birds are placed in the north-Venezuelan subspecies appears to be unsatisfactory, and a study of material from these various regions shows the recognition here of four, instead of two, subspecies to be amply justified. Accordingly I describe the two additional forms hereunder. Furthermore, a large series of specimens from southern Brazil, Paraguay, and northern Argentina indicates the definite division of *auricapillus*, as at present recognized, into two subspecies, of which the new one also is characterized and named below.

Basileuterus trifasciatus nitidior Chapman

Basileuterus trifasciatus nitidior CHAPMAN, 1924 (Nov. 6), Amer. Mus. Novitates, no. 143, p. 8—El Chiral, southwestern Ecuador; ♂; Amer. Mus. Nat. Hist.

The realignment of the boundary between Perú and Ecuador a few years ago makes it possible to include the present form in the Peruvian list on the basis of specimens from Alamor, Cebollal, and Guainche. There are no other records.

Basileuterus culicivorus austerus, new subspecies

TYPE: From Buena Vista, above Villavicencio, Eastern Andes, Colombia; altitude 4500 feet. No. 122674, American Museum of Natural History. Adult male collected March 4, 1913, by George K. Cherrie; original no. 16389.

DIAGNOSIS: Nearest to *B. c. olivascens* of Trinidad, but back darker and browner; rufous of central crown averaging deeper; dusky postocular stripe broader, involving the upper part of the auriculars; subocular white patch usually more extensive.

RANGE: Eastern side of the Eastern Andes of Colombia below Bogotá, and Mt. Macarena; known also from "Bogotá-skins."

DESCRIPTION OF TYPE: Center of crown Orange-Rufous × Sanford's Brown with rather prominent pale gray tips; center of occiput and nape near Olive-Gray × Light Neutral Gray; this light central area bordered laterally on each side by a prominent

blackish stripe reaching from the base of the bill to the hind neck; upper part of lores broadly whitish, narrowing slightly to form a light superciliary stripe that becomes somewhat more grayish over the auriculars; lores sooty blackish; behind the eye a sooty stripe that broadens to include the upper part of the auriculars, the lower part of which is Light Neutral Gray; base of auriculars and subocular space broadly white, forming a conspicuous patch. Back Deep Olive, passing into a lighter tone on the upper tail-coverts. Chin and malar apex narrowly whitish; most of under parts Pale Lemon Yellow, somewhat paler on the under tail-coverts and darkening to Pyrite Yellow on the sides and flanks. Remiges dark Mouse Gray, somewhat paler on narrow outer margins of the primaries and with narrow white inner margins; upper wing-coverts like the back; under wing-coverts pale yellowish white; axillars duller, grayish olive at tips. Tail dark Mouse Gray with outer margins basally olive like the back. Bill (in dried skin) dark brown; feet fleshy brown. Wing, 65 mm.; tail, 54; exposed culmen, 10; culmen from base, 13.6; tarsus, 20.

I have not seen examples from the Río Caura, Venezuela, reported as *olivascens*, and cannot say whether they belong to that form or to the present one. It is possible that they belong to *B. c. segrex* which occurs not very far to the eastward.

Basileuterus culicivorus occultus, new subspecies

TYPE: From Peque, Antioquia, Colombia; altitude 5000 feet. No. 134102, American Museum of Natural History. Adult male collected February 4, 1915, by Leo E. Miller and Howarth Boyle; original no. 11066.

DIAGNOSIS: Nearest to *B. c. cabanisi* of northern Venezuela but distinguishable by the darker crown-patch and darker auriculars, with the upper portion of the latter merging into the post-auricular stripe.

RANGE: Mountains above the Cauca Valley in the Central and Western Andes of Colombia; possibly also western slope of Western Andes.

DESCRIPTION OF TYPE: Head pattern as described for *B. c. austerus* but center of crown a little darker, and (in all the specimens of the present series) largely concealed beneath the gray tips of the feathers; back near Deep Grayish Olive (much grayer than in *austerus*). Chin and malar apex narrowly whitish; most of under parts Light Lemon Chrome; under tail-coverts

whitish with yellowish tinge basally; outer margins of remiges ashy gray; under wing-coverts and axillars white. Bill and feet as in *austerus*. Wing, 59 mm.; tail, 50; exposed culmen, 10; culmen from base, 13; tarsus, 20.

REMARKS: Five specimens from Primavera, 1700 meters elevation, may possibly indicate the occurrence of this form on the western side of the Western Andes, but there is some uncertainty as to the exact position of the locality in question. They are from the Rothschild Collection, obtained from a collector by the name of Raap, but I have been unable to find any positive information as to most of the localities represented in his material. Judging by the serial numbers on the field labels, the following sequence of localities obtains: Cali, San Isidro (900 meters), Media Luna (900 meters), Primavera (1700 meters), "W. Colombia," Primavera, "Yuntas" (400 meters). It has been supposed by various workers that these localities, with the exception of Cali, are on the western side of the Western Andes, probably in the Dagua Valley, but there is no proof of it. There is a Primavera at about the right elevation in the Cauca Valley south of Caldas and well northward of Cali, and on the way to this place there is a Media Luna, although at a little higher elevation than Raap's labels indicate. There is a San Isidro west of Cali, on the western side of the Andes, but it is well below 900 meters and not in the Dagua Valley, and there is a Las Juntas also on the west slopes at a low elevation. Until material is at hand from localities known to be on the western side of the cordillera, I must query that portion of the suggested range, although it is not improbable.

This small series is consistently distinguishable from *cabanisi*. Most of my material of that form is from the Mérida region, but two examples are from El Limón, slightly east of the type locality of *cabanisi*, while Mérida is at a greater distance to the westward.

I find *B. c. indignus* from Santa Marta very difficult to distinguish from *cabanisi*. It averages a very little lighter yellow on the under parts and usually has the auricular region paler and more whitish, but these characters are no more constant than the yellow, instead of orange-tinged, crown-patch. In 18 specimens of *cabanisi*, six have a deeply colored crown-patch, four have the area yellow with an orange tinge, and eight have it simple yellow. In eight skins of *indignus*, three have a yellow crown,

three have it tinged with orange, and two have it as deeply colored as any *cabanisi*. The proportion of individuals with simple yellow crown-patch is thus greater in *cabanisi* than in *indignus*, as far as the present limited material indicates. Mr. Todd, however, has reported a much greater preponderance of yellow in a larger series of *indignus* than I have examined, and in view of this and the additional average characters I have mentioned above, I provisionally accept *indignus*.

Basileuterus culicivorus azarae, new subspecies

TYPE: From Sapucay, Paraguay. No. 505746, American Museum of Natural History. Adult male collected June 3, 1900, by William Foster; original no. 15.

DIAGNOSIS: Similar to *B. c. auricapillus* of Rio de Janeiro (type locality here further restricted to Therezopolis), by duller and more brownish olive mantle. Slightly darker backed than *B. c. segrex* of Mt. Roraima, Venezuela, and external margins of the remiges distinctly olivaceous or brownish olive, not gray.

RANGE: Southern Brazil from the Organ Mountains (southwestern Rio de Janeiro) to Rio Grande do Sul, and westward through São Paulo to Matto Grosso; also Paraguay; northern and eastern Argentina (Buenos Aires; Tucumán).

DESCRIPTION OF TYPE: Center of crown Orange-Rufous × Cinnamon-Rufous with conspicuous grayish tips; center of hind neck Olive-Buff × Smoke Gray; this central area bordered laterally by a broad brownish black stripe on each side converging at the base of the culmen; anterior and upper lores and nasal feathering dull whitish, continued posteriad in a superciliary stripe which develops a narrow streak of clearer white on the upper eyelid and becomes duller again over the auriculars; a dusky spot immediately in front of the eye and a postocular stripe of similar dusky brown; below the eye an ill-defined whitish lunule; auriculars dull brownish, somewhat whitish anteriorly. Mantle Buffy Olive × Light Brownish Olive; uropygium near Yellowish Olive. Chin narrowly whitish; throat light Strontian Yellow, passing into Strontian Yellow × Wax Yellow on the central part of the breast and belly; sides dark grayish; flanks tinged with olive; under tail-coverts lighter yellow than the belly. Remiges dark brownish, with exposed outer margins and upper wing-coverts like the mantle; under wing-coverts pale yellow; inner margins of remiges narrowly whitish. Tail dark brown with outer mar-

gins like the mantle. Bill (in dried skin) light brown; feet light brown. Wing, 58 mm.; tail, 52.5; exposed culmen, 9.6; culmen from base, 13.5; tarsus, 19.

REMARKS: Females like the males, apparently in size as well as coloration.

From the material at hand, *B. c. auricapillus* appears to occur in the State of Rio de Janeiro in the Organ Mountains and in at least adjacent parts of Minas Gerais and Espirito Santo. It is separable from *azarae* by its greener back, a character that I cannot match in over a hundred examples from other Brazilian states nor from Paraguay and Argentina. The character has been noted previously by Todd (1929, Proc. U. S. Natl. Mus., vol. 74, p. 69) who was unable to define the possible range and refrained from describing a new form for that reason. Birds from the Serra de Itatiaia have a tendency toward *auricapillus* but are still nearer *azarae* (as Todd also noted), while one specimen from Espirito Santo (Santa Barbara de Caparaó) suggests the Itatiaia characters but remains a little brighter and nearer *auricapillus*.

Basileuterus c. viridescens of eastern Bolivia is again more greenish above than *azarae*, but the tone is lighter and duller than that of *auricapillus* from which it is easily distinguished.

Four specimens from Bahia and Ceará are puzzling and may represent a still different subspecies, being lighter and grayer above than either *auricapillus* or *azarae*, but they are not sufficiently convincing to enable me to define such a new form, and I leave them for future workers to study when more material is available from the area involved.

Since Azara first described the Paraguayan birds, I have named the new form for him.

SPECIMENS EXAMINED

B. t. trifasciatus.—
PERÚ:
Palambla, 4 ♂, 2 (?);
Seques, 2 ♂, 3 ♀, 1 (?);
San Felipe, Río Huancabamba, 1 ♂.

B. t. nitidior.—
ECUADOR:
(El Chiral, Celica, Punta Santa Ana, Guachanamá, Zaruma, San Bartolo, Loja, Las Piñas, and Lunamá), 16 ♂, 14 ♀, 2 (?).
PERÚ:
Alamor, 7 ♂, 4 ♀;

Cebollal, 2 ♂;
Guainche, 1 ♂.

B. c. indignus.—
COLOMBIA:
Santa Marta (Onaca, Minca, and Las Nubes), 1 ♂, 1 ♀, 7 (?).

B. c. occultus.—
COLOMBIA:
Peque, Antioquia, 1 ♂ (type);
Primavera, 5 ♂;
Miraflores, east of Palmira, 1 (?).

B. c. austerus.—
COLOMBIA:
Buenavista, E. Andes, 1 ♂ (type), 2 ♀;
Villavicencio, 1 (?);
Mt. Macarena, 1 ? ♂.

B. c. cabanisi.—
COLOMBIA:
Cúcuta, 1 ♂.
VENEZUELA:
(Mérida, Escorial, Culata, El Valle), 3 ♂, 3 ♀, 10 (?);
El Limón, 2 (?).

B. c. olivascens.—
VENEZUELA:
(Santa Ana Valley, Campos Alegre Valley, Quebrada Seca, San Antonio, La Tigrera, Cocallar, Montaña de Guácharo, Cristóbal Colón, "Venezuela"), 18 ♂, 7 ♀.
TRINIDAD:
(Princestown, Caparo, Carenage, Laventille, and Heights of Aripo), 9 ♂, 11 ♀, 2 (?).

B. c. segrex.—
VENEZUELA:
Mt. Roraima, Paulo, 8 ♂ (including type), 1 ♀;
Arabupú, 5 ♂, 1 ? ♀, 3 ♂ [1], 2 ♀ [1];
(Altiplanicie de Nuria, El Palmar, Cerro Tomasote, Cerro Ptari-tepui, La Paragua, and Cerro Tigre), 5 ♂ [1], 8 ♀ [1], 5 (?)[1].

B. c. viridescens.—
BOLIVIA:
Province of Sara, 5 ♂, 2 ♀.

B. c. azarae.—
ARGENTINA:
Tucumán (above San Pablo, Tafí trail, Sarmiento, and Ocampo), 5 ♂, 6 ♀;
Buenos Aires, Barracas al Sud, 1 ♂, 2 ♀.
PARAGUAY:
Sapucay, 6 ♂ (including type);
(Río Negro, east of Caaguassú, upper Iguassú River, east of Yhú, Colonia Independencia, Abai, and Niu Poná), 6 ♂, 5 ♀, 4 (?).

[1] Specimens in Phelps Collection, Caracas.

BRAZIL:

Matto Grosso (Utiarity and Rio Amambahy), 1 ♂, 1 ♀;

Rio Grande do Sul (Candiota, Sapyranga, Hamburgo Velho, Nonohay, Erebango, Lagoa de Forno, Santa Cruz, Campo Bom, Sananduva, and Sinimbú), 16 ♂, 5 ♀, 5 (?);

Santa Catharina (Ilha Redonda, Salto Pirahy, Cerro Verde, Palmital, and Rio Cascalho), 2 ♂, 5 ♀, 4 (?);

Paraná (Tibagy, Porto Almeida, Foz de Iguasú, Guayra, Porto Mendez, Castro, and Corvo), 13 ♂, 7 ♀, 2 (?);

São Paulo (Fazenda Cayoá and São Sebastião), 3 ♂, 3 ♀;

Rio de Janeiro (Monte Serrat, Maceiras, and Ponte Maromba), 6 ♂, 2 ♀, 2 (?).

B. c. auricapillus.—

BRAZIL:

Rio de Janeiro, Therezopolis, 9 ♂, 5 ♀;

"Rio-skin," 1 (?);

Espirito Santo (Engenheiro Reeve and Santa Barbara de Caparaó), 2 ♂;

Minas Gerais (Rio Caparaó, Cachoeira de Fumaza, Fazendinha, Bôa Espera, Fazenda Emmerinck, Pico de Bandeira, and Santa de Padre Venina), 6 ♂, 6 ♀.

R. c. subsp. ?—

BRAZIL:

Bahia, Jaguaquara, 1 (?);

Ceará, Viçosa, 1 ♀, 2 (?).

Basileuterus coronatus coronatus (Tschudi)

M[yiodioctes] coronatus TSCHUDI, 1844 (May), Arch. Naturgesch., 10th year, vol. 1, p. 283—Perú = Chanchamayo Valley.

This form, with the greenish back, heavy black lateral crown-stripes, gray or black forehead, and greenish flanks, ranges from central Perú southeastward to the Urubamba Valley and presumably to the Bolivian border. A single specimen from the extreme southeastern region is somewhat equivocal since it approaches the still darker *notius* of the adjacent parts of Bolivia. From a geographical point of view, it may well represent an extreme variant of that form, but Todd and Hellmayr agree in referring other southeast-Peruvian specimens to *coronatus*, and in the absence of more material I follow their lead.

The case is otherwise with respect to north-Peruvian specimens. Todd (1929, Proc. U. S. Natl. Mus., vol. 74, pp. 35, 36) referred two Uchco birds to *coronatus* and 12 others from near-by northern localities to the west-Ecuadorian *elatus*, while Hellmayr (1935, Field Mus. Nat. Hist., zool ser., vol. 13, pt. 8, p. 516) assigned all of these northern birds (of which he had seen eight examples)

to *coronatus*. Both authors, however, note the intermediate character of the north-Peruvian specimens.

With 15 birds at hand from the critical region (and earlier notes on three others) the relative stability of the characteristics of this population becomes apparent and I believe indicates the desirability of recognizing a new subspecies from this part of Perú. It is accordingly described below.

Records that remain with *coronatus* are from Chanchamayo, Vitoc, Huaynapata, Garita del Sol, Paltaypampa, and near Torontoy.

Basileuterus coronatus inaequalis, new subspecies

TYPE: From San Pedro, south of Chachapoyas, Perú; altitude 8600–9400 feet. No. 235638, American Museum of Natural History. Adult male collected January 23, 1926, by Harry Watkins; original no. 10025.

DIAGNOSIS: Nearest to *B. c. elatus* of northwestern Ecuador, but differs by slightly darker back, gray instead of rufescent nape (centrally), usually duller forehead (buffy instead of rufous in most cases), and very slightly greater average lengths of wing and tail. Differs from *B. c. coronatus* of central and southern Perú by more golden olive back and flanks, buffy or rufescent forehead instead of gray or blackish, narrower lateral crown-stripes, slightly lighter gray sides of the head, and less purely white and grayish throat, which is lightly drab-tinged.

RANGE: Subtropical Zone of the Central Andes of northern Perú.

DESCRIPTION OF TYPE: Top of head medially dark Sanford's Brown, changing abruptly to Neutral Gray on the hind neck, and anteriorly nearly reaching the base of the bill where, however, the forehead is narrowly warm buff; on each side of the central area is a relatively narrow black stripe, broadening somewhat posteriorly on the hind neck but very weak above the lores; upper part of lores pale buff, merging into a prominent superciliary stripe of light Neutral Gray; ante-ocular patch and postocular stripe sooty blackish; an inconspicuous whitish subocular lunule; auriculars light gray with inconspicuous, short, whitish shaft-streaks anteriorly. Back Citrine × Orange-Citrine; upper tail-coverts slightly tinged with brownish. Chin and throat Pale Smoke Gray, somewhat darker (Smoke Gray) laterally and posteriorly; breast and belly deep Strontian Yellow × Wax

Yellow, with the breast somewhat obscured by brownish olive tips; sides Buffy Citrine; flanks near Orange-Citrine; under tail-coverts Aniline Yellow with narrow external margins of Mars Yellow on the longer feathers. Wings, upper wing-coverts, and tail brownish, with exposed outer margins like the back; under wing-coverts dull, pale yellowish with a dark area at base of primaries; inner margins of remiges light smoky gray. Bill (in dried skin) dark brown; feet light brown. Wing, 73 mm.; tail, 66; exposed culmen, 11; culmen from base, 15; tarsus, 24.

REMARKS: Females about like the males in coloration, perhaps averaging slightly clearer on throat and breast; size smaller: wing, 65–69 (average, 66.5); tail, 55–60.5 (average, 57.8). Males, wing, 69–74 (average, 71.5); tail, 58–64 (average, 62). These measurements approximate those of *c. coronatus* but are smaller than those of *elatus* in which the largest extremes in the series at hand are: wing, 71.5; tail, 60 (different birds).

Immature examples have the rufous area of the cap duller than that of adults and further obscured by brownish olive tips on the feathers. The dark lateral stripes are very weak or obsolete as is the postocular stripe, leaving the sides of the head nearly uniform dark brown. The back is darker and browner than that of the adults, and the outer margins of the greater upper wing-coverts are somewhat brighter than in fully grown birds. One young bird has the under surface throughout clouded by dark tips on the feathers.

Only one specimen of *inaequalis* at hand shows any definite trace of rufescence on the nape, and that is weakly suggested. On the other hand, one specimen of *elatus* has the nape gray as in the present form, although one other, from Pallatanga, has only a weak suggestion of rufescence in the area. The remaining examples of *elatus* have prominent rufescence in the nuchal area, only a little lighter in tone than the color of the crown.

Records that belong with *inaequalis* are from Cocochó, Tamiapampa, Ray-urmana, and Levanto.

I see no reason why *castaneiceps* and its related white-bellied conspecies may not be included in the *coronatus* group. The dorsal coloration follows the same pattern and manner of variation, and the sole distinction between the two sets of forms lies in the presence or absence of yellow on the lower under parts. This is in part overcome by the individual variation of the white-

bellied forms, some examples of which show very definite yellow tendencies, albeit not to the depth of hue shown by *coronatus* and the similarly marked forms.

There is good geographic replacement among the various forms, with the interesting fact that the white-bellied subspecies occur in a group between two separated sets of the yellow-bellied ones—*regulus* and *elatus* in Venezuela, Colombia, and northwestern Ecuador, and *inaequalis*, *coronatus*, and *notius* from north-central Perú to Bolivia.

Basileuterus coronatus castaneiceps Sclater and Salvin

Basileuterus castaneiceps Sclater and Salvin, 1877, Proc. Zool. Soc. London, p. 521—"Jina" [= Jima], Ecuador; Brit. Mus.

Birds from the Pacific side of the Western Andes of northern Perú are easily referable to the southwest-Ecuadorian form. I have no certain evidence that this form crosses to the eastern side of this cordillera in Perú, although two birds from Loja, Ecuador, indicate such a crossing in southern Ecuador. Two specimens from Lomo Santo, south of Jaén, Perú, were referred by Todd to *castaneiceps*, but I believe they are better assigned to *chapmani* as is discussed under that form.

There are no Peruvian records other than of the birds listed with the material examined herewith.

Basileuterus coronatus chapmani Todd

Basileuterus castaneiceps chapmani Todd, 1929, Proc. U. S. Natl. Mus., vol. 74, p. 32—Chaupe, Perú; ♂; Amer. Mus. Nat. Hist.

This dark-backed form has a very restricted range on the eastern side of the Western Andes of northern Perú. On the western side of that range, it is replaced by *castaneiceps*, while across the Marañón, in the Central Andes, the yellow-bellied *inaequalis* occupies the corresponding habitat.

Two specimens from Lomo Santo, south of Jaén, were referred by Todd to *castaneiceps*, but I believe must belong to *chapmani*. One of them is definitely in agreement with Chaupe birds and while the other (without given sex) is light-backed enough to match certain examples of *castaneiceps*, it is darker than some other specimens of that form. In addition, the locality is in the same orographic position as Chaupe and Tambillo which Todd places in the range of *chapmani*.

It may be noted that a very minor error occurs in the original description of *chapmani*. The date of collection of the type specimen was February 10 instead of February 14 as given. There is little likelihood of any confusion resulting from the typographical error, but it may be as well to correct it here.

Other than the localities of the specimens at hand, there are records from Tambillo and Cutervo.

SPECIMENS EXAMINED

B. c. regulus.—
VENEZUELA:
(Nevados and Culata, Mérida region), 5 ♂.
COLOMBIA:
(Miraflores, Tornel, above Salento, Almaguer, Laguneta, Cerro Munchique, Las Lomitas, Subia, San Antonio, Santa Elena, El Eden, La Candela, Aguadita, El Roble, Fusagasugá, and "Bogotá"), 23 ♂, 18 ♀, 15 (?).
B. c. elatus.—
ECUADOR:
(Gualea, Mindo, west side of Pichincha, Canzacota, Verdecocha, road to Nanegal, Pallatanga, and "Quito"), 10 ♂, 3 ♀, 1 (?).
B. c. castaneiceps.—
ECUADOR:
(Loja, Zaruma, Taraguacocha, Salvias, El Chiral, and "Govinda" [? = Guainche, Perú], 6 ♂, 4 ♀, 2 (?).
PERÚ:
El Tambo, 1 ♂, 1 ♀;
Palambla, 3 ♂, 2 (?);
Taulis, 1 ♂, 3 ♀;
Seques, 2 ♂.
B. c. chapmani.—
PERÚ:
Chaupe, 3 ♂ (including type), 1 (?);
Lomo Santo, 1 ♀, 1 (?).
B. c. orientalis.—
ECUADOR:
Upper Sumaco, 5 ♂ (including type);
Oyacachi, 2 ♀;
lower Río Sardinas, 1 ♀;
Baeza, 3 ♂, 1 ♀;
above Baeza, 2 ♀;
Baños, 1 (?);
Puente del Río Quijos, 1 ♀;
Galgalan, Río Upano, 1 (?).
B. c. inaequalis.—
PERÚ:
San Pedro, 3 ♂ (including type), 3 ♀;
Chachapoyas, 1 ♀;
Leimebamba, 1 ♂;

Molinopampa, 1 ♂[1];
Uchco, 1 ♂[1], 1 ♀[1];
La Lejia, 4 ♂, 2 ♀, 1 (?).

B. c. coronatus.—
PERÚ:
Chinchao, 1 ♀[1];
Chilpes, 1 ♂, 3 ♀, 1 (?);
Utcuyacu, 3 ♂, 5 ♀;
Rumicruz, 1 ♂, 4 ♀;
Santa Rita, Urubamba, 1 ♀;
San Miguel, 1 ♂, 1 ♀, 1 (?);
Idma, 2 ♂, 1 ♀;
Inca Mine, 1 ♂.

B. c. notius.—
BOLIVIA:
Locotal, 1 ♀;
Roquefalda, 1 ♀.

Basileuterus fraseri fraseri Sclater

Basileuterus fraseri SCLATER, 1883, Proc. Zool. Soc. London, p. 653, pl. 61—part; Pallatanga, Ecuador; Brit. Mus.

I can find no distinctions between Peruvian and Ecuadorian birds of this subspecies which is not surprising considering the limited range of the entire species.

The boundary treaty between Perú and Ecuador of a few years ago appears to require the inclusion of the specimens from La Puente, Guainche, Cebollal, and Alamor in the Peruvian list, although the localities were Ecuadorian at the time the birds were collected, and the latter have heretofore been discussed by Chapman and others as then properly Ecuadorian in origin.

There are no additional Peruvian records.

Intergradation between *fraseri* and *ochraceicrista* takes place at the head of the Gulf of Guayaquil where examples from the Río Chimbo show definite intermediacy. On the whole, however, they are closer to *fraseri*. Those that show the greatest resemblance, among the specimens at hand, are not fully adult and have the rufescent crown which young *fraseri* possess in distinction from the adults of that form but in common with adult and young *ochraceicrista*.

SPECIMENS EXAMINED

B. f. fraseri.—
ECUADOR:
(La Chonta, Santa Rosa, Pullango, Las Piñas, Zaruma, Río Jubones,

[1] Specimens in Chicago Natural History Museum.

Portovelo, El Chiral, Salvias, Naranjo, Chimbo, Cocó, Bucay, Punta Santa Ana, and Lunamá), 28 ♂, 19 ♀, 9 (?).

PERÚ:

Paletillas, 3 ♂, 3 ♀, 1 (?);
Milagros, 1 ♂;
Palambla, 1 ♂, 5 ♀;
La Puente, 2 ♂;
Guainche, 1 ♂, 3 ♀;
Cebollal, 1 ♂;
Alamor, 2 ♂, 2 ♀.

B. f. ochraceicrista.—

ECUADOR:

Chone, 2 ♂ (including type), 1 ♀;
Chongocito, 1 ♂, 1 ♀;
Chongon Hills, 1 ♂;
Salado, 1 (?);
Guayaquil, 1 ♂.

Basileuterus rivularis semicervinus Sclater

Basileuterus semicervinus SCLATER, 1860, Proc. Zool. Soc. London, vol. 28, p. 84—Nanegal, western Ecuador; ♂, ♀ cotypes in Brit. Mus.

This form occurs in Perú only in the extreme northwestern part of the country from which a single specimen is at hand, collected at Cebollal. The bird was recorded by Chapman in his Ecuadorian volume, 1926, at which time the locality was in Ecuador.

The allocation of the form to the species *rivularis* is discussed below in the account of a new subspecies from southeastern Perú.

Basileuterus rivularis fulvicauda (Spix)

Muscicapa fulvicauda SPIX, 1825, Avium species novae, . . . Brasiliam, vol. 2, p. 20, pl. 28, fig. 2—no locality; São Paulo de Olivença, Brazil, suggested by Todd, 1929; Munich Mus.

Basileuterus uropygialis poliothrix BERLEPSCH AND STOLZMANN, 1896, Proc. Zool. Soc. London, p. 331—La Gloria and La Merced, Dept. Junín, Perú; ♂ ♂ cotypes in Frankfort Mus. and (?formerly) Warsaw Mus.; I select La Gloria as restricted type locality.

Phaeothlypis semicervina annexa TODD, 1929, Proc. U. S. Natl. Mus., vol. 74, art. 7, pp. 9, 15—Pomará, lower Marañón, Perú; ♀; Amer. Mus. Nat. Hist.

I am unable to recognize either *annexa* or *poliothrix* as distinct from *semicervinus*. Five specimens from the range of *annexa*, including the type, are easily matched in a good series from localities ranging from eastern Ecuador to the upper Río Ucayali, Perú, and including a single bird from Calamá, Rio Madeira, Brazil. Likewise, a virtual topotype of *poliothrix*, while at the

lighter extreme of variation of *fulvicauda*, can be matched by other examples in the series. Farther to the southeastward, certain characters develop to a degree that makes recognition of a distinct form possible, but they are not apparent in the central Peruvian specimen at hand.

In addition to the lighter general coloration of *fulvicauda* as compared with *semicervinus*, apparent not only in the paler coloration of the dorsal surface but in the less deeply ochraceous and more extensively whitish under parts, the markings on the outermost rectrices present an excellent character. In *semicervinus* the outer feather sometimes is uniformly cinnamomeous, but usually there are some dark markings, rarely crossing both webs uninterruptedly and then apparently not extended noticeably basad along the outer web. In *fulvicauda* there is usually a complete dark band, terminal except for a fine, pale margin, and occasionally interrupted next to the shaft on the outer web, leaving the outer margin of this web dark for some distance basad. The general tone of coloration of the dark band on the remaining rectrices is lighter and less sooty than in *semicervinus*. The width of the band is about the same as in *semicervinus*, or a little greater; in *semicervinus* the band is the narrowest of any in the known forms of the species.

A single specimen from Zamora, Ecuador, has been referred by various authors to *semicervinus* in spite of the position of the locality on the eastern side of the Andes, but I believe this assignment is incorrect. The bird is darker above than most *fulvicauda* and has the under parts rather evenly ochraceous over most of the area, but it can be matched by several undoubted *fulvicauda* while the tail markings are definitely those of that form.

Berlepsch and Stolzmann described "*poliothrix*" from two specimens, neither of which was designated as type in the original account. Stolzmann (1927) claimed the La Gloria skin in the Warsaw Museum as type, while Hellmayr (1935) claimed that honor for the La Merced example in the Berlepsch Collection, Frankfort Museum, where it presumably bears that indication in Berlepsch's handwriting. Since the Warsaw Museum specimen is likely to have disappeared, it is perhaps advisable to restrict the type locality, as is done above, to the locality of the Frankfort Museum specimen, although both examples should be considered as original cotypes.

Peruvian records assignable to *fulvicauda* include those from Chayavitas, Santa Cruz (Río Huallaga), Moyobamba, Yurimaguas, Huambo, Perené, La Merced, Chanchamayo, La Gloria, Amable Maria, and probably Monterico.

The situation in Colombia is very puzzling. There appears to be a gradual transition from *semicervinus* in the west toward *fulvicauda* in the east, and it is difficult to draw any exact lines of demarcation. Judging by the material at hand, the birds from the western side of the Western Andes are the darkest and most positive *semicervinus*, agreeing with topotypes and other west-Ecuadorian specimens. Birds from the Cauca Valley are very slightly lighter in dorsal coloration, showing more olive in the general tone of the back, while the under parts remain as deeply colored. A series of "Bogotá skins" averages even lighter and more greenish above although, as in the case of the Cauca Valley specimens, some examples may be matched with light extremes from the Pacific slopes. A single example from Chicoral, upper Magdalena Valley, is at the lightest extreme and in addition has the under parts as pale as many *fulvicauda*, to which form the specimen has previously been assigned. The tail in all these birds, including the Chicoral skin, shows the characteristic markings of *semicervinus*, and unless a new form is to be established for the eastern population, assignment to *semicervinus* is indicated. The Chicoral bird may be but an exceptionally pale example of the population resident in its area, and I am unwilling to attempt a description of a possible new form hereabouts on the basis of "Bogotá skins" or without a series from the upper Magdalena. The range would be difficult to establish.

This last assertion is made in view of four examples from Mt. Macarena, southeast of Bogotá. While there is no assurance that these birds would be matched by specimens from the eastern face of the Eastern Andes as at Villavicencio (from which area no material has been examined), such correlation is quite probable. In any case, the Macarena specimens are intermediate between the Bogotá series and typical *fulvicauda*, being closer to *fulvicauda* in dorsal coloration and tail markings, though more deeply (though not more extensively) rufescent on the under side. Since the tail markings are perhaps the most definite of any of the characters, I believe that assignment of the Macarena birds to *fulvicauda* is justified, although they are not typical.

As noted above, birds from southeastern Perú are distinct from

the other Peruvian specimens and deserve recognition, as described below:

Basileuterus rivularis significans, new subspecies

TYPE: From La Pampa, southeastern Perú, Tropical Zone. No. 146394, American Museum of Natural History. Adult male collected October, 1916, by Harry Watkins; original no. 220.

DIAGNOSIS: Differs from *B. r. fulvicauda* of central and northern Perú and eastern Ecuador by lighter and more greenish olive back and broader dark terminal portion of the tail (except for narrow pale margin), with the light basal portion entirely concealed by the upper and under tail-coverts; the dark area lighter and more greenish than in *fulvicauda;* outer web of outermost rectrices dark except at extreme base (but with a narrow pale tip); the under parts more extensively whitish. Differs from *B. r. bolivianus* of northern Bolivia by the presence of the buff uropygium and base of tail, and apparently also (in the specimens examined) by less strongly buffy breast and less purely white belly.

RANGE: Known only from the southeastern part of Perú, in the Tambopata and Inambari drainage.

DESCRIPTION OF TYPE: Top of head Deep to Dark Mouse Gray, becoming a little lighter over the auriculars; a few feathers on the anterior part of crown with concealed white bases; a prominent superciliary stripe dull Vinaceous Buff, becoming weaker posteriorly past the orbit; back Deep Olive, changing abruptly to warm Naples Yellow on the lower rump and upper tail-coverts. Lores, below the superciliary stripe, broadly blackish; a weak blackish stripe behind the eye; subocular space broadly buff, darkening on the auriculars to merge with the supra-auricular color; malar region somewhat brownish; chin, throat, breast, and belly light Cartridge Buff, deeper on the sides and flanks which are tinged with Hair Brown; under tail-coverts light Cream-Buff. Remiges dark brown with exposed outer margins olivaceous, brighter greenish on the secondaries and tertials than on the primaries; upper wing-coverts like the back; under wing-coverts Grayish Olive with carpal margin broadly more buffy. Basal portion of tail, well beneath the coverts, Cream-Buff × Pinkish Buff; beyond this base the exposed portions of the feathers dorsally light Yellowish Olive, with the inner webs of all but the median pair somewhat duller and with pale cinnamomeous inner margins and whitish tips, broadest on outermost pair;

outer web of outermost pair olive except at the extreme base and tip; inner web with the basal light color restricted to the basal half of the feathers and not at all sharply defined. Bill (in dried skin) brownish black; feet pale brown. Wing, 66 mm.; tail, 52; exposed culmen, 10; culmen from base, 15; tarsus, 21.

REMARKS: The dorsal coloration of this form is matched rather closely by that of *B. rivularis bolivianus* except for the presence of the ochraceous buff upper tail-coverts and base of the tail which do not appear in *bolivianus*, nor in *rivularis* and *mesoleucus*. Nevertheless, the reduction of the ochraceous area in *significans* is a marked approach to the condition in *bolivianus* and the other two forms mentioned, and it would not be too much to expect an even greater degree of intermediacy than is visible in the skins at hand. For example, two males from the Río Tavara have broad olive tips on some of the upper tail-coverts, while a topotype of uncertain sex has the bright basal area of the tail restricted to the basal fourth on the median rectrices. A good series of *bolivianus* might possibly show a corresponding development of basal color that is not evident in the three birds at hand, none of which is topotypical. Thus, although perfect intergradation is not demonstrable, the resemblance between the two sets of populations is so great, with geographical replacement evident, that I believe the relationship is best expressed by placing *fulvicauda* and its immediate affines in the same species with *rivularis*. Records from Yahuarmayo belong with *significans*.

SPECIMENS EXAMINED

B. r. leucopygius.—
NICARAGUA:
(Savala, Río Grande, Matagalpa, Río Tuma, and Las Cañas), 3 ♂, 3 ♀.
COSTA RICA:
(La Iberia, Puerto Jiménez, Miravalles, La Hondura, Bonilla, Cariblanco, and Guacimo), 11 ♂, 5 ♀.
PANAMÁ:
Almirante, 1 ♂, 1 ♀;
Guaval, 1 ♂ (type of *gaffneyi*);
Río Calovevora, 2 ♂.

B. r. veraguensis.—
COSTA RICA:
Buenos Aires, 1 ♂, 1 ♀;
Boruca, 1 ♂, 1 ♀.
PANAMÁ:
[Lion Hill], 1 ♂, 1 ♀, 1 (?);
Boqueron, 1 ♂ (type of *toddi*);

Bogava, 1 ♂;
Capira, 1 ♂;
Wilcox Camp, 1 ♂;
Boquete, 1 (?);
Cerro Larga, Cape Mala Peninsula, 1 ♂;
Cerro Montoso, 1 ♀.

B. r. semicervinus.—
PANAMÁ:
(Cituro, Tapalisa, and Tacarcuna), 9 ♂, 1 ♀, 2 (?).
COLOMBIA:
(Barbacoas, Jiménez, Yuntas, Juntas de Tamaná, Río Barratón, Nóvita, Bagado, Ricaurte, Cuaque el Destino, Alto Bonito, San José, Puerto Valdivia, Peque, Chicoral, and "Bogotá"), 12 ♂, 7 ♀, 13 (?).
ECUADOR:
(Nanegal, Cachabí, Esmeraldas, La Chonta, Río de Oro, Chimbo, San Javier, and Paramba), 11 ♂, 9 ♀.
PERÚ:
Cebollal, 1 ♂.

B. r. fulvicauda.—
COLOMBIA:
Mt. Macarena, 2 ♂, 1 ♀, 1 ?♂.
ECUADOR:
(Below San José, lower Río Suno, and Zamora), 2 ♂, 6 ♀.
PERÚ:
Mouth of Río Curaray, 2 ♀;
Orosa, 1 ♀;
Pomará, 2 ♂, 1 ♀ (type of *annexa*);
Huarandosa, 2 ♀;
Perené, 1 ♀;
Lagarto, Río Ucayali, 1 ♀;
Santa Rosa, 2 ♂.
BRAZIL:
Rio Madeira, Calamá, 1 ♂.

B. r. significans.—
PERÚ:
La Pampa, 1 ♂ (type), 1 (?);
Río Tavara, 2 ♂, 1 ♀;
Astillero, 1 ♀.

B. r. bolivianus.—
BOLIVIA:
Vermejo, 1 ?♂, 1 ♀;
Tres Arroyos, 1 ♀.

B. r. rivularis.—
BRAZIL:
"Brasil," 1 ♂, 1 ♀, 1 (?) (all cotypes);
São Paulo, Fazenda Cayoá, 4 ♂, 2 ♀;
"Bahia," 1 (?);
Santa Catharina, Salto Pirahy, 1 ♂, 2 ♀;
Palmital, 1 ♂, 1 ♀;

Espirito Santo, Segrado do Veado, 2 ♂, 1 ♀.

B. r. mesoleucus.—

Brazil:

Rio Xingú, Villarinho do Monte, 2 ♂, 2 ♀.

French Guiana:

Approuague, 2 ♂;

Cayenne, 1 (?).

British Guiana:

Kamarang River, 1 ♂, 1 ♀;

Rockstone, 1 ♀;

Minnehaha Creek, 1 ♂;

Tumatumari, 1 ♂, 1 ♀, 1 (?).

Venezuela:

Mt. Auyan-tepui, 1 ♂, 1 ♀;

Mt. Duida, foot, 2 ♂;

Río Orinoco, Suapure, 1 ♂.

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A STUDY OF THE COLETO OR BALD STARLING (*SARCOPS CALVUS*)

BY E. THOMAS GILLIARD

In the course of studies relating to the birds of Bataan Peninsula, Luzon, I have had occasion to examine critically 111 study skins of the monotypic Philippine genus *Sarcops* from the islands of Luzon, Catanduanes, Mindoro, Panay, Samar, Mindanao, Basilan, and the Sulu group.

I am grateful to Dr. John T. Zimmer, Dr. Ernst Mayr, and Dr. Dean Amadon of the American Museum of Natural History for their generous assistance in technical matters connected with this paper, and to Dr. Eduardo Quisumbing and Dr. Canuto Manuel of the National Museum of the Philippines for the loan of Bataan study skins.

Casual observations of Coletos collected on Bataan caused me to question the validity of the so-called color phases which have long been attributed to *S. calvus* and, in due course, to reëxamine Grant's hypothesis (1895, Ibis, pp. 258–260) that these plumage differences represent geographical variation, not seasonal, sexual, or age factors.

The initial idea of color phases was introduced by Bowdler Sharpe (1890, Catalogue of the birds in the British Museum, vol. 13, p. 97) in annotations concerning the validity of *Sarcops lowii* which he had earlier described (*Sarcops lowii* Sharpe, 1876, Trans. Linnaean Soc., ser. 2, vol. 1, p. 344; Sibutu Island) from the southernmost island in the Sulus. He wrote: "Both males and females are in the [Philippine] collection with the back entirely grey, and the breast entirely black. From the remains of grey both above and below overspreading the black plumage, it would appear that the pure silvery-grey colour is a seasonal plumage."

Confident that the coloration of upper parts in this species was

due to geographical factors, Grant later named the dark-backed birds *S. melanonotus* (1906, Bull. Brit. Ornith. Club, vol. 16, p. 100; Davao). In his description he wrote: "[Males and females] differ from the adult of *S. calvus* (Linn.) in having the upper-back smoky black instead of silvery grey."

Grant (*op. cit.*) presented his original hypothesis regarding the geographical distribution of the types of dorsal coloration of *S. calvus* in a confusing manner. He wrote: " . . . We find that east of longitude 122 degrees, or thereabout, all the Philippine examples of *S. calvus* have the mantle and upper back brownish black; while west of this line all have the upper parts uniform silvery grey; intermediate forms being met with only in localities situated along the line where the two forms intergrade." Actually the distribution of this species is much more clearly definable on the basis of latitude, for nearly all of central and northern Luzon lies west of longitude 122° E., and the remainder of the Philippine Archipelago, except the western half of Basilan Island, lies east of it.

The most recent reference to color phases in the Coleto appears in Delacour and Mayr's "Birds of the Philippines" wherein Mayr (1946, pp. 244–245) writes: "Mantle black or silvery grey . . . the black-backed color phase being the most common on the eastern islands."

In the opinion of the author, the following is the true picture concerning this problem:

1. The dorsal color phases that have long been attributed to this species are in reality relatively stable characters associated with geographical variation, except in birds from southern Luzon which are in a state of flux.

2. Four morphological characters vary geographically. In order of importance these are (1) color of back, (2) color of under tail coverts, (3) length of tail, and (4) length of wing.

Generally speaking *S. calvus* is divisible into two main types: (1) a silver-backed group which inhabits north and central Luzon, Mindoro, and the Sulus, and (2) a black-backed group which occurs on Samar and eastern Mindanao.

The silver-backed group may be subdivided into at least three races, as follows:

1. *Sarcops calvus calvus* (Linnaeus) (*Gracula calva* Linnaeus, 1766, Systema naturae, vol. 1, p. 164). Northern and central Luzon. This small form (see table 1) has the under tail coverts strongly tipped with gray. Birds from southern Luzon are provi-

sionally included with this form, although they are quite variable. About half of the 45 examples before me from Sorsogon and Camarines have dark gray backs; the remainder are as light above as the nominate population of the north. It is this south Luzon population that probably gave rise to the belief in color phases. A single dark-backed specimen from Catanduanes Island is included with this subspecies.

2. A form herein described from Mindoro Island which is similar to central and northern Luzon birds but larger.

3. An undescribed race from the central Sulu Islands which differs from *calvus* by having under tail coverts black or black with subobsolete gray tipping, not black strongly tipped with gray. Judging from Grant's (*op. cit.*) description of the type and only known specimen of Sharpe's *lowii* from Sibutu Island in the southern Sulus, there can be little doubt that the above undescribed form is distinct from it. Grant writes: "This allied form, of which only the type is known, has the sides of the chest and the whole of the underparts grey, with only a line of blackish feathers down the middle of the belly, and appears to me to be perfectly distinct from *S. calvus*, which is found in the adjacent Tawi Tawi group and northwards throughout the Philippines. I think Dr. Sharpe was right in the first instance when he described the Sibutu bird as distinct." As pointed out in the introduction, Sharpe later erroneously concluded that the black underparts of *S. calvus* were due to seasonal change. Because of this belief he united his *S. lowii* with it. I have seen no specimen in the extensive material at hand which fits the above description of *lowii*, but I am convinced that additional material from Sibutu Island will confirm the validity of this race and permit description of the aforementioned undescribed population.

In this connection, it is well to point out that several species are known to have distinct racial representatives on Sibutu and Tawi-tawi. In fact, the most pronounced zoological break extant in the Sulu Archipelago occurs between these two closely situated islands.

The black-backed group is composed of one well-marked race and one race-in-the-making as follows:

1. *Sarcops calvus melanonotus* Grant (*op. cit.*) of eastern Mindanao and Samar (?) which is deep black across the shoulders. This is the smallest of the forms. A single specimen from Samar differs from topotypical *melanonotus* from southeastern Mindanao

by reason of longer wing and tail and more extensive black upper parts. Additional material is needed before an accurate interpretation can be made of these apparent differences.

2. A large, dark gray-backed population inhabiting the peninsula of Zamboanga, western Mindanao, and Basilan Island. The specimens at hand from western Mindanao originated in the vicinity of Ayala, a prison in the western coast of Zamboanga near the southwestern extremity of the peninsula. They agree with a series from Basilan Island and together they appear to represent a distinct but poorly marked intermediate population between *melanonotus* of eastern Mindanao and the undescribed form believed to inhabit the central Sulus. A single female from Panay appears to belong here.

The new form from Mindoro Island is to be known as herein named and described.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Sarcops calvus mindorensis, new subspecies

TYPE: From the base of Mt. Dulungan, Mindoro Island, Philippine Islands. No. 667051, American Museum of Natural History, Rothschild Collection. Adult male collected January, 1896, by J. Whitehead.

DIAGNOSIS: Nearest to *calvus* of central and northern Luzon, but with a considerably longer tail and wing (see table 1); white central shaft streaks on throat more profuse in fully adult birds.

RANGE: Probably restricted to Mindoro Island.

DESCRIPTION OF TYPE: Head with large, nude, circumocular wattles; the crown narrowly feathered on the midline and occiput with Black; other areas surrounding the wattles, including forehead, lores, malar regions, and auriculars, Black; hind neck, sides of neck, back, rump, upper tail coverts, flanks silvery gray, a little lighter than Pallid Neutral Gray, becoming somewhat darker, more Pale Neutral Gray on the shoulders and the central back; remainder of bird black, the wings and tail with a deep greenish cast; the feathers of the throat with fine white central streaks broadening terminally and contrasting vividly against the black of the throat. Bill (in dried skin) glossy black; feet brownish black. Wing, 140 mm.; tail, 125.5; culmen from base, 30; bill from anterior edge of nostril, 19; tarsus, 33.

REMARKS: Males and females are apparently similar in coloration and size. The white throat markings are very pronounced in the type and in the single female at hand. They are less distinct in the two remaining males which, in other respects, appear completely adult.

TABLE 1

MEASUREMENTS OF MALES

	Wing		Tail	
S. c. calvus				
1 Benguet, northern Luzon	—		105.0	
7 Lamao, central Luzon	127–135	(130.5)	105–113.5	(110.5)
1 Laguna de Bay, central Luzon	129.0		—	
1 Sampaloc, central Luzon	130.0		113.5	
1 Tayabas, southern Luzon	132.0		110.0	
14 Sorsogon, southern Luzon	13: 123.5–132.5	(128.8)	10: 104–117	(110.5)
S. c. mindorensis				
3 Mindoro Island	134–140	(136.2)	119–125.5	(121.5)
S. c. subspecies?				
5 Sulu Islands (central)	129–136	(133.5)	113–120	(116.0)
S. c. melanonotus				
1 Samar Island	132		113	
3 Davao and Daliaun, southern Mindanao	122–130	(127)	99–105	(102.3)
S. c. subspecies?				
2 Ayala, Zamboanga, western Mindanao	133–134	(133.5)	106–111	(108.5)
6 Basilan Island	128.5–133.5	(131.2)	101–112	(106.8)

SPECIMENS EXAMINED

Sarcops calvus calvus:

LUZON ISLAND:

Benguet, 1 ♂; Lamao, Bataan, 8 ♂[1], 10 ♀[1], 2 ?[1]; Mt. Mariveles, Bataan, 1 ♀; Mt. Maquilling, Laguna, 1 ♂; Sampaloc, 1 ♂, 1 ♀; San Antonio, 1 ♂; Calauan, 1 ♀; Tayabas, 1 ♂, 2 ?; Camarines, 7 ♂, 7 ♀; Sorsogon, 14 ♂, 18 ♀; Luzon, 3 ?; "Philippines," 2 ?

CATANDUANES ISLAND:

Catanduanes Island, 1 ♀.

Sarcops calvus mindorensis:

MINDORO ISLAND:

Base of Mt. Dulungan, 1 ♂ (type); Calapan, 1 ♂; Baco, 1 ♀; Mindoro Island, 1 ♂.

[1] Four ♂, 5 ♀, 1 ? in the National Museum of the Philippines.

Sarcops calvus melanonotus:
SAMAR ISLAND:
Bonga, 1 ♂.
MINDANAO ISLAND:
Davao, 1 ♂; Daliaun, 2 ♂, 1 ♀; Mindanao, 1 ?
Sarcops calvus subspecies ?:
MINDANAO ISLAND:
Ayala, 2 ♂, 1 ♀.
BASILAN ISLAND:
Basilan Island, 6 ♂, 2 ♀.
PANAY ISLAND:
Panay Island, 1 ♀.
Sarcops calvus subspecies ?:
SULU ISLANDS:
Bongao Island 1 ♂;
Sulu Island, 4 ♂, 1 ?;
Tiangi, Sulu Island, 1 ♀.

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NEW AND LITTLE-KNOWN FALSE SCORPIONS FROM VARIOUS PARTS OF THE WORLD (ARACHNIDA, CHELONETHIDA), WITH NOTES ON STRUCTURAL ABNORMALITIES IN TWO SPECIES

BY JOSEPH C. CHAMBERLIN[1]

This paper is a report on miscellaneous new and little-known species of false scorpions, mostly of the subfamily Cheliferinae, which the author accumulated over a period of several years. These specimens are from California, Virginia, Florida, Africa, Crimea, Tibet, India, Australia, and New Zealand. It was originally intended to incorporate these descriptions in various revisional studies. Since these revisions will be long deferred, it seems best to publish the descriptions at this time in order to validate important names and to correct certain errors. Acknowledgments are made under the various specific headings.

Some structural abnormalities are noted in connection with *Synsphyronus mimetus* Chamberlin and *Xenochelifer davidi*, new genus and species.

All types, unless otherwise specified, are in the collections of the American Museum of Natural History.

All microscopic slides bearing types, important specimens, or other preparations are marked distinctively with the slide numbers of the author (for example, JC-1731.02001), which follow citation of such specimens.

[1] United States Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, Forest Grove, Oregon.

SUBORDER HETEROSPHYRONIDA CHAMBERLIN

FAMILY **CHTHONIIDAE** HANSEN

Chthonius (Ephippiochthonius) californicus J. C. Chamberlin

Figure 1

Chthonius californicus J. C. CHAMBERLIN, 1929, Ann. Mag. Nat. Hist., ser. 10, vol. 4, p. 74; 1931, Stanford Univ. Publ., Univ. Ser., Biol. Sci., vol. 7, no. 1, p. 50, fig. 9B (carapace).

Chthonius (*Ephippiochthonius*) *californicus* J. C. Chamberlin, BEIER, 1932, Das Tierreich, vol. 57, p. 57.

MATERIAL: Male holotype (JC-66.01001) and female allotype (JC-66.01002), collected at Berkeley, California, January, 1920. Also one additional female (JC-323.01001) collected by P. N. Annand at base of cypress tree, Half Moon Bay, San Mateo County, California, January 20, 1925. Types deposited in Cornell University collections.

DIAGNOSIS (EMENDED): Carapace subquadrate of typical facies; smooth; with four relatively small eyes, the anterior pair of which are corneate and spaced about an ocular diameter from the anterior carapacal margin and from the posterior pair of eyes, respectively; chaetotaxy 4–2 (18).

Abdomen of typical facies; tergal chaetotaxy (female; segments 1–12), 4:4:4:4:6:6:6:6:6:4:6:0. Sternal chaetotaxy (female; segments 3–12), 9:7:9:7:6:6:6:7:0:2. The anterior genital operculum of the female (sternites 1 and 2) with eight setae, of which six are ranged, three on a side, to form an inverted "V," while the remaining two are paired therein. The internal lateral genital guard setae of the male are longitudinally divided on either side into two groups of two setae each, separated by a non-setose hiatus (in the holotype, at least).

Chelicerae (fig. 1C) typically with seven setae on palm (two lateral subbasal and one sublateral median accessory setae); spinneret present as a sclerotic protuberance.

Palps of normal appearance; chela (fig. 1A) with the typical ephippiochthoniine dorsal depression distad on the tactile setae of the hand; derm smooth. Fixed finger of chela with about 11 to 13 prominent and well-spaced teeth distally and about the same number of small, rounded, contiguous teeth proximally; movable finger with six to eight prominent, spaced teeth distally and 15 to 18 small, rounded, contiguous teeth proximally (fig. 1B).

Palpal proportions: trochanter 1.6 to 1.8 times as long as broad; femur 4.85 (in male) and 5.0 to 5.2 (in the female) times as long as

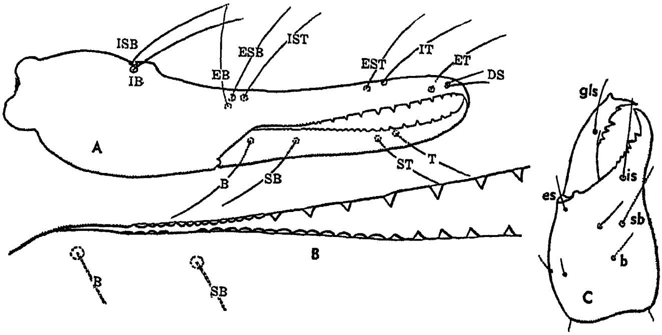

FIG. 1. *Chthonius* (*Ephippiochthonius*) *californicus* Chamberlin (all illustrations from female JC-323.01001). A. Interior aspect of left chela. B. Dental margin of fixed (upper) and movable (lower) fingers of chela showing detail of basal dentition. C. Exterior aspect of left chelicera.

broad; tibia 1.8 to 1.9 times as long as broad; chela 5.0 (in the male) and 3.9 (in the female) times as long as broad; hand 2.07 (in the male) and 1.6 to 1.7 (in the female) times as long as broad; finger 1.3 to 1.4 times as long as the hand in both sexes. Chela (both sexes) 1.3 to 1.5 times as long as femur and 3.2 to 3.3 times as long as tibia.

Miofemur of leg IV (female only; male not known), 2.2 times as long as deep; tibia 3.6 to 3.7 times as long as deep.

MEASUREMENTS (MM.): Male (holotype): Total length exclusive of chelicerae 1.21. Carapace .359 long; chelicerae .261 by .140. Palps: trochanter .149 by .084; femur .448 by .092; tibia .196 by .104; chela .653 by .131; hand .271 long; finger .383 long; total length of palps 1.446.

Female (allotype): Total length 1.36. Palps: trochanter .168 by .103; femur .522 by .103; tibia .224 by .121; chela .718 by .183; hand .299 long; fingers .420 long; total length of palps 1.632 mm.

Female (JC-323.01001): Total length 1.44. Carapace .426 long; chelicerae .344 by .167. Palps: trochanter .170 by .103; femur .553 by .107±; tibia .221 by .125; chela .731 by .189±; hand .317 long; fingers .421 long; total length palp 1.675. Leg I: basifemur .303 by .073; telofemur .139 by .062; tibia .182 by .048; miotarsus .325 by .037; total length (excluding coxa and trochanter) .949. Leg IV: miofemur .503 by .230; tibia .343 by .094; metatarsus .177 by .070; telotarsus .325 by .037; total length (excluding coxa and trochanter) 1.348.

REMARKS: The holotype and allotype of this species are no longer available for study, and this redescription is based upon brief unpublished notes taken on these specimens and on the single additional female studied since the original description was prepared. This specimen was compared closely with the allotype in 1928, when it was noted that "it differs by its greater size and more acutely shouldered femur. Otherwise typical."

The apparent depression in which IB and ISB occur, as shown in figure 1A, may not be accurate. The chela in question was treated with KOH and may merely be slightly shrunken at this point. The illustration of the carapace published in 1931 omits the interocular seta evident in the female now before me. It was probably broken from the original specimen and hence escaped observation. Or it may possibly be truly absent, a point which cannot at present be checked. The measurements of total length as given in the original description are in error. The true lengths are as given herein.

KLEPTOCHTHONIUS, NEW GENUS

Heterochthonius J. C. CHAMBERLIN, 1929, Canadian Ent., vol. 61, p. 153 (original diagnosis as a subgenus of *Apochthonius*). BEIER, 1932, Das Tierreich, vol. 57, p. 42 (maintained as a subgenus of *Apochthonius*). HOFF, 1945, Trans. Amer. Micros. Soc., vol. 64, no. 4, pp. 313–314 (revised diagnosis; group regarded as of full generic rank).

GENEROTYPE (ORTHOTYPE): *Apochthonius* (*Heterochthonius*) *crosbyi* J. C. Chamberlin.

REMARKS: *Kleptochthonius* is proposed to replace the name *Heterochthonius* J. C. Chamberlin, which was described in 1929 as a subgenus of *Apochthonius*. *Heterochthonius* Chamberlin, 1929, is a homonym of *Heterochthonius* Berlese, who employed the name in 1910 for a genus of oribatid mites (see Ewing, 1917, Ann. Ent. Soc. Amer., vol. 10, p. 125).

Chamberlin's diagnosis of 1929 as modified by Hoff's revision of 1945 for *Heterochthonius* will define the genus.

SUBORDER DIPLOSPHYRONIDA CHAMBERLIN

FAMILY **GARYPIDAE** HANSEN

Synphyronus (Synophyronus) mimetus J. C. Chamberlin

Figure 2

Synsphyronus paradoxus TUBB (*nec* Chamberlin; misdet.), 1937, Proc. Roy. Soc. Victoria, new ser., vol. 49, no. 2, p. 412.

Synsphyronus (*Synsphyronus*) *mimetus* J. C. CHAMBERLIN, 1943, Ent. Soc. Amer. Ann., vol. 36, pp. 492–496, figs. 3 (eyes), 6 (carapace and anterior tergites), 8 (pseudoderm), 10 (flagellum), 11 (chelicera), 12 (leg IV), 15 (leg I), 18 and 20 (fourth tarsus), 22 (chela), 25 and 27 (female and male palps).

MATERIAL: Through the courtesy of Dr. J. A. Tubb I have been privileged to examine four males and one female (JC-1602.01001–5) of this species collected by him on Lady Julia Percy Island, Australia, in January, 1936. It was stated to be the commonest species on the island. These specimens were erroneously determined and recorded by Tubb as *Synsphyronus paradoxus* Chamberlin.

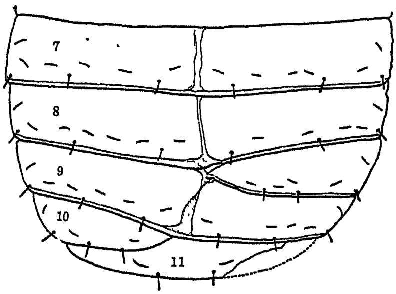

FIG. 2. *Synsphyronus* (*Synsphyronus*) *mimetus* Chamberlin. Tip of abdomen showing abnormal tergal segmentation (specimen JC-1602.01005).

REMARKS: One of the male specimens (JC-1602.01005) in the above lot shows an interesting segmental abnormality involving tergites 8, 9, and 10, but not the corresponding ventral segmentation, which is completely normal. Essentially, it appears that tergite 9 obliquely bisects tergite 10, so that the right half of tergite 9 is caudad of 10, while the left half of tergite 9 is situated normally with respect to 10. This oblique position of tergite 9 causes the two scuta of tergite 10 to narrow rapidly mesally, finally pinching out entirely medially. The abnormality also causes a slight distortion in tergite 8, the left scutum of which is slightly but distinctly broader than the right. The undivided tergite 11 is nearly normal, but is also affected to some extent, being somewhat better developed on the right than on the left side. Figure 2 graphically shows the nature of this interesting abnormality.

SUBORDER MONOSPHYRONIDA CHAMBERLIN

FAMILY **CHERNETIDAE** MENGE

PHOBEROCHEIRUS, NEW GENUS

GENEROTYPE (ORTHOTYPE): *Phoberocheirus cribellus*, new species.

DISTRIBUTION: United States of America, North Carolina.

DIAGNOISIS: (Based on male only; female unknown.) Chernetine genus related to *Dendrochernes* and *Pachycheirus*.

Carapace and basal palpal segments more or less granulate; vestitural setae thickened to strongly denticuloclavate on dorsal surfaces of body and appendages (fig. 3C, D, E). Completely eyeless, but weakly defined eye spots present; carapace somewhat longer than broad, with two well-defined transverse furrows. Abdomen broad, subovate, tergites with intersegmental and interscutal membranes prominent and papillate, merging gradually into the squamose tessellations of the scuta proper; tergites and sternites uniseriate (except for the usual lateral discal setae) and bordered by 18 to 20 setae, which are strongly clavate dorsally (fig. 3E) and acuminate ventrally; pleural membrane hispidously papillate; tergites 1 to 10 and sternites 4 to 10 divided into scuta by a comparatively broad membranous stripe; tergite and sternite 11 entire, reduced, and each more or less fitted into the concavity of the recurved tenth segment; sternite 11 (and probably tergite 11 also) with a lateral pair of acuminate tactile setae.

Chelicerae small; flagellum with four blades, of which the anteriormost only is anteriorly denticulate (fig. 3G); chaetotaxy of palm normal, with setae *sb* and *b* both relatively short, robust, and completely acuminate.

Palps probably strongly differentiated sexually; those of male extremely robust (fig. 3A). Chela with an enormously expanded hand which bears interiorly a large area of densely clustered sense spots which occupies the distal half of the hand (fig. 3J). Chaetotaxy and dentition of chela as illustrated (fig. 3B). Movable finger with ST and T closely associated, distad of nodus ramosus and widely separated from SB and B, with a slender pseudotactile seta ventrad of and median between ST and T. Fixed finger with IT subterminal and about as far proximad of ET as IST is distad of EST; IT closer to ET than to IST; accessory teeth occur paradentally exteriorly and interiorly.

Legs of usual facies; fourth tarsus (fig. 3F) with a dorsal subbasal sense dome and a short but acuminate pseudotactile seta

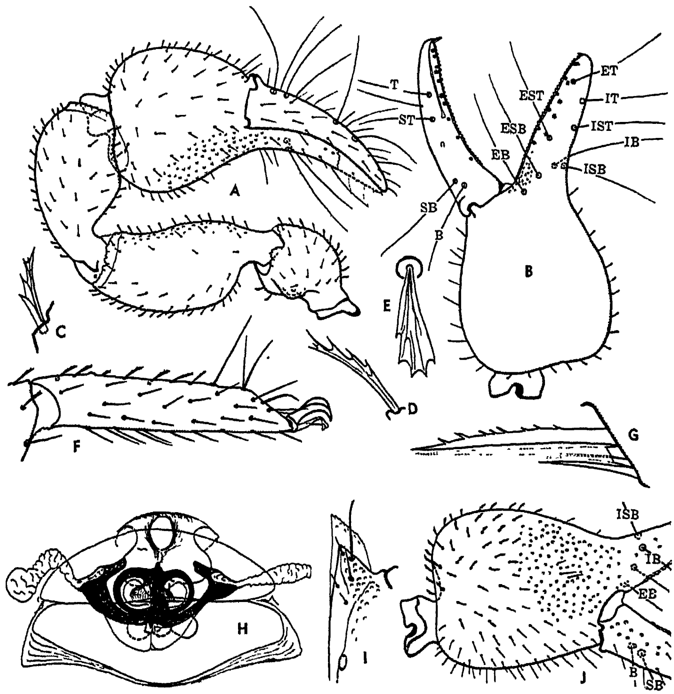

FIG. 3. *Phoberocheirus cribellus*, new species (all drawings from male holotype). A. Ventral aspect of right pedipalp. B. Exterior aspect of left chela showing dentition, chaetotaxy, and venom apparatus. C. Vestitural seta of palps. D. Vestitural seta of tarsus. E. Vestitural seta of carapace. F. Fourth tarsus. Note distal tactile seta. G. Flagellum (reconstructed in part). H. Sketch of male genitalic structures. I. Apex of maxilla showing apical and subapical setae. J. Interior aspect of hand and base of fingers. Note the extensive sensory area.

situated less than the tarsal depth proximad of the apical setae (about .7 of the total, or .9 of the dorsal, tarsal length from its base).

Apical seta of maxilla much shorter than the subapical seta (fig. 3G).

REMARKS: Close to both *Pachycheirus* and *Dendrochernes*, but differing in the strongly clavate tergal and carapacal setae and in the chaetotaxy of the chela. The large sense spot area of the inner, distal face of the hand is unique. Only the orthotype can presently by assigned to this genus.

Phoberocheirus cribellus, new species

Figure 3

MATERIAL: Holotype, male (JC-1731.02001), collected at Vienna, Virginia, November, 1942, "from the 1942 nest of *Bombus americanorum* in flying squirrel nest in black oak stub twenty feet above the ground" by J. C. Bridwell. No other material known. The type collection, however, also included a male of *Mirochernes dentatus* (Banks).

DIAGNOSIS: Small species of extremely robust facies. Carapace longer than posterior breadth; eye spots very weakly defined or absent; anterior furrow caudad of median, sharply defined and nearly transverse; posterior furrow also transverse, situated closer to the posterior carapacal border than to the median furrow; evenly but relatively sparsely granulate, the granulation most distinct laterally; bordered posteriorly by about 14 setae; vestitural setae conspicuously denticuloclavate (fig. 3E).

Tergites as described under generic heading; vestitural setae strongly denticuloclavate as on carapace; chaetotaxy:

$$16{:}17{:}\frac{2\text{-}0}{17}{:}\frac{2\text{-}0}{18}{:}\frac{2\text{-}0}{18}{:}\frac{2\text{-}0}{18}{:}\frac{2\text{-}0}{19}{:}\frac{2\text{-}0}{18}{:}\frac{2\text{-}0}{17}{:}\frac{4}{14}{:}\frac{4}{\text{T5T}}{:}2\text{m}.$$

The tactile setae indicated for segment 11 may not actually occur (all setae broken from this segment), but their presence is probable as judged from the size of the seta areoles. Tergite and sternite 11 with scutal surface sparsely sprinkled with microlyrifissures, especially caudally. Sternites nearly smooth, weakly squamotessellate; vestitural setae acuminate; chaetotaxy (segments 2–12):

$$(35){:}(3)\ \frac{(21)}{15}\ (3){:}(1)10(1){:}\frac{0\text{-}4}{19}{:}\frac{0\text{-}3}{18}{:}\frac{2\text{-}1}{17}{:}\frac{2\text{-}4}{17}{:}\frac{2\text{-}3}{13}{:}\frac{6}{11}{:}\frac{\text{TT}}{\text{T6T}}{:}2\text{m}.$$

The discal tactile setae indicated for sternite 11 may not actually occur (setae lost and character inferred from size of areoles). Sternites 4 to 7 with a more or less distinct discal zone of scattered microlyrifissures.

Genital structures of male of usual type, general appearance as sketched (fig. 3H).

Chelicera of usual appearance; galea short with very minute terminal branches, serrula exterior with about 17 ligulate teeth; serrula interior with slender, dentate apical process and three

dentate subapical lobes; seta *b* shorter than *sb;* all setae of chelicera completely acuminate.

Palps extremely robust (fig. 3A). Trochanter squamosely granulate both anteriorly and posteriorly, with a small posterior and larger dorsal protuberance; 1.53 times as long as broad. Femur moderately granulate dorsally, interiorly, and exteriorly; strongly pedicellate, especially posteriorly; bulb broadest proximad of median; 1.89 times as long as broad. Tibia strongly pedicellate, bulb subterminally slightly excavated distally; granulate distally on inner face but smooth elsewhere; 2.00 times as long as broad. Chela (fig. 3B, J) smooth except for weakly developed granulate area interiorly at base of fixed finger; with hand enormously expanded interiorly and dorsally; condylar development of movable finger conspicuous; interior and distal half of hand to base of fingers with a conspicuously defined area of thickly clustered sense spots. Chela 2.13 (including pedicel 2.28) times as long as broad; hand scarcely longer than broad; depth and breadth subequal; fingers distinctly (1.17 times) longer than hand exclusive of the pedicel; venom duct .41 as long as finger. Marginal teeth of chela contiguous and numbering about 37 on either finger; fixed finger exteriorly with an evenly spaced series of closely paradental accessory teeth; interiorly with a similar series of five large accessory teeth which are not closely paradental; movable finger exteriorly with a closely paradental series of seven or eight small accessory teeth and interiorly with two large submedian accessory teeth.

Legs of usual facies but more robust than usual. Leg I: "miofemur" 2.84 times as long as deep; tibia 3.46 times as long as deep; miotarsus 5.00 times as long as deep. Leg IV: "miofemur" 3.12 times as long as deep; tibia 4.27 times as long as deep; miotarsus (fig. 3F) 5.05 times as long as deep. Tarsal tactile seta short, .88 of dorsal and .70 of total tarsal length from the base; tactile seta itself about 1.5 times as long as depth of tarsus and completely acuminate.

Measurements (mm): Male (holotype): Total length 2.00. Abdominal breadth .98. Carapace: .72 long; ocular breadth .39; posterior disk .12 long. Palps: trochanter .410 by .267; femur .582 by .308; tibia .597 by .298; chela 1.009 (with pedicel 1.082) by .474 broad and .467 deep; hand .497 long; fingers .581 long; venom duct .241 long. Leg I: "miofemur" .418 by .147; tibia .343 by .099; miotarsus .315 by .063. Leg IV:

"miofemur" .589 by .189; tibia .487 by .114; miotarsus .394 by .078; tactile seta .277 from base of tarsus and .098 long; dorsal length of tarsus (to apical setae) .317.

FAMILY **CHELIFERIDAE** HAGEN

SUBFAMILY **CHELIFERINAE** SIMON

TRIBE **CHELIFERINI** CHAMBERLIN

XENOCHELIFER, NEW GENUS

GENEROTYPE (ORTHOTYPE): *Xenochelifer davidi*, new species.

DISTRIBUTION: United States of America, southern California.

DIAGNOSIS: Cheliferine genus of typical facies. Carapace densely granulate; with a few scattered larger tubercles; with true corneate eyes; with two rather weakly defined transverse furrows; posterior disk of male with lateral crests; vestitural setae short, distinctly clavate.

Abdomen ovate; tergites 1 to 10 and sternites 4 to 10 more or less distinctly divided by a longitudinal linear stripe or impression (line of division not necessarily membranous on anterior tergites particularly); tergite and sternite 11 distinct, almost entire (partially divided at most); pleural membrane nearly smooth, striate but not evenly so; vestitural setae short, denticulo-clavate; sternal setae on segments 3 to 8 nearly or quite acuminate, on terminal segments thickened to weakly clavate; tergite and sternite 11 with a posterior zone of sparsely scattered micro-lyrifissures; sternite 11 with a submedian pair of short, acute, pseudotactile setae. Tergal chaetotaxy distinctly biseriate; sternal chaetotaxy uniseriate except for the usual lateral discal seta; male tergites with well-developed lateral crests or keels; tergites evenly, squamosely granulate; sternites nearly smooth but distinctly squamotessellate.

Genital structures of male of typical cheliferine facies (fig. 5D, E); statumen convolutum medially incised and with a distinct median process; ramshorn organs present and normally developed; coxal sacs of usual cheliferine facies, lacking a differentiated atrium and opening on the medioventral face of the fourth coxae which are also provided with prominent lateral spurs. Female genital area of usual facies; median cribriform plates paired, separate, and distinct (fig. 5A).

Chelicerae small, of normal facies; chaetotaxy of normal cheliferine type; setae *sb* and *b* short, robust, and terminally more or

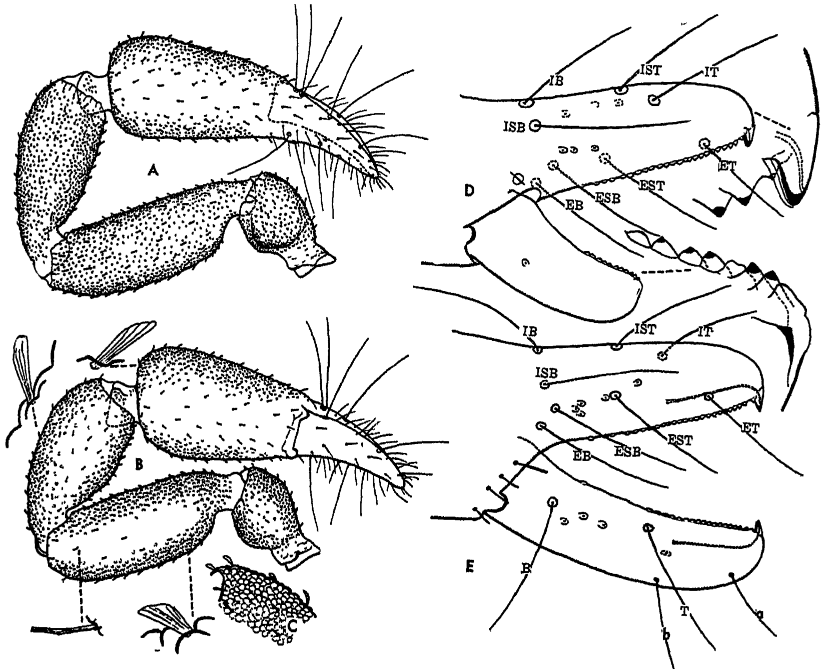

FIG. 4. *Xenochelifer davidi*, new species. A. Dorsal aspect of left pedipalp, male (JC-252.04001). B. Ventral aspect of right pedipalp, female (allotype). C. Detail of dermal ventral sculpture of palpal trochanter (allotype). D. Interior aspect of deformed left chela of male holotype. The shortened movable finger lacks tactile setae and venom apparatus. Inserts: details of dentition and other terminal structures of fixed and movable fingers. E. Exterior aspect of normal right chela of male holotype.

less clavate (fig. 5F); no accessory setae; galea not markedly differentiated sexually; flagellum 3 bladed; serrula exterior with about 16 to 18 ligulate blades.

Palps robust, femur and tibia definitely pedicellate; evenly and densely granulate except for the fingers; vestitural setae very short, stout, and thickened to prominently clavate (fig. 4A, B). Chaetotaxy of chela as illustrated (fig. 4E), unique among all hitherto known Cheliferidae in lacking two of the usual four tactile setae on the movable finger (setae ST and SB apparently absent); seta IST about opposite EST; seta IT distinctly distad of EST but closer to IT-EST than to ET. Movable finger with two slender pseudotactile setae, one subterminal, the other almost median (slightly

distad of seta "T"). Venom apparatus present in both fixed and movable fingers; venom duct about one-third the total length of the finger; nodus ramosus situated opposite the fifteenth to eighteenth marginal tooth; marginal teeth well developed on both fingers; a few sense spots present exteriorly and interiorly.

Legs of usual facies. Tarsal claws (fig. 5P) simple and untoothed; subterminal setae dorsally monodentate (fig. 5N–P); fourth tarsus with a short and nearly terminal tactile seta situated scarcely caudad of the apical setae (fig. 5K). Male fore tarsus (fig. 5L) swollen and markedly differentiated from the others; with a well-developed terminal spine; fore claws markedly asymmetrical.

REMARKS: This presently monotypic genus is unique in the reduced chaetotaxy of the chela (setae ST and SB presumably absent). Possibly in correlation with the loss of setae ST and SB, two slender, pseudotactile setae occur on the movable finger, ventrodistad of seta T. It is to be emphasized that these setae are not "true" tactile setae, as is clear from the nature of the areoles.

Xenochelifer davidi, new species

Figures 4 and 5

MATERIAL: Holotype, male (JC-552.04003); allotype, female (JC-552.04004); paratopotypes, male and female (JC-552.04001 and 552.04002). All from the United States, California, Los Angeles County, Big Rock Creek, under cottonwood bark, April 25, 1926. Coll. J. C. Chamberlin. An additional female paratype is available (JC-492.01001), labeled "Sud California (Morr. 81) (5.194)," belonging to the Paris Museum and lent through the courtesy of M. Louis Fage.

DIAGNOSIS: Carapace posteriorly broader than long, densely granulate and with scattered larger tubercles laterally; eyes about their own diameter from the anterior carapacal margin; transverse furrows weakly defined; posterior disk of male with well-defined lateral crests; vestitural setae short and denticuloclavate.

Tergites granulosquamose; tergites 1 to 10 more or less clearly divided by a linear suture or stripe; 11 nearly entire, but with a partial division visible anteriorly; vestitural setae prominently denticuloclavate (fig. 5G). Tergites of female: 1 to 3 irregularly uniseriate, with 15 to 18 marginal setae; 4 to 11 irregularly biseriate, the discal row comprising 12 to 18 setae (fewer on posterior

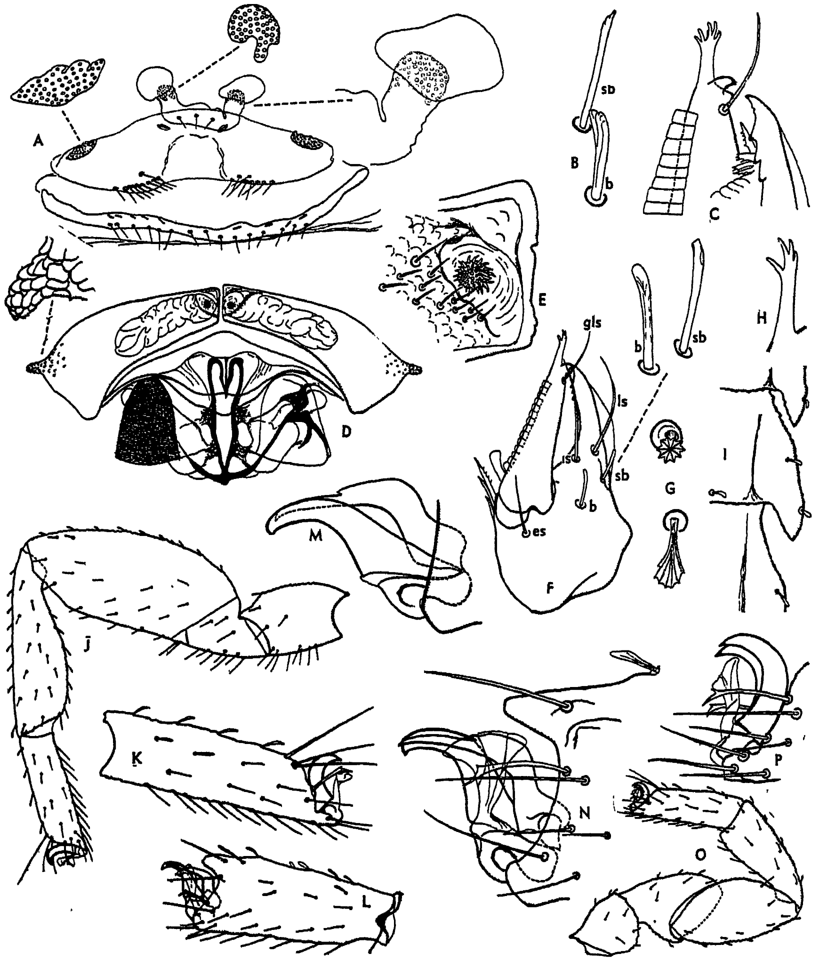

FIG. 5. *Xenochelifer davidi*, new species. A. Genital area of female showing chaetotaxy, seminal receptacles, and cribriform plates. Inserts: details of cribriform plate (492.01001). B. Subbasal and basal setae of chelicera, male (252.04001). C. Tip of cheliceral fingers and galea of female (492.01001). D. Male genitalic structures including fourth coxae and coxal sacs. Insert: heavily sculptured spur of fourth coxa. E. Detail showing ventral opening of coxal sac on fourth coxa. F. Exterior aspect of left chelicera, serrula interior omitted. Insert: details of subbasal and basal setae of chelicerae, male (holotype.) G. Subterminal (upper) and lateral (lower) aspects of tergal vestitural setae (holotype). H. Galea of male (holotype). I. Tergal crests of segments 5, 6, and 7, male (holotype). J. Lateral aspect of leg IV, female (252.04002). K. Fourth tarsus of female showing chaetotaxy and claws (252.04002). L. Fore tarsus of male (holotype). M. Asymmetrical fore claw of male (other structures omitted (holotype). N. Praetarsus of leg I, male (holotype). O. Fore leg of female (252.04002). P. Praetarsus of leg I, female (252.04002).

segments); anal operculum with the usual pair of microsetae. Tergites of male with well-developed lateral crests on segments 1 to 9, vestigial on segment 10; chaetotaxy essentially as in female, except that tergites 1 to 3 have a lateral discal seta situated on the lateral crests. Sternites smooth, but markedly squamo-tessellate in stained material, 4 to 10 completely divided by linear stripe; 11 nearly entire, but with an anterior notch and a distinct longitudinal impression; vestitural setae simple and acute on segments 4 to 8; thickened and terminally bluntly denticulate to weakly clavate on segments 9 to 11. Sternal chaetotaxy (female): anterior spiracular guard sclerite non-setose, posterior guard sclerites monosetose; all sternites uniseriate, except for the usual pair of lateral discal setae which occurs on segments 5 to 10, border setae (observed range in two specimens) as follows (segments 3 to 12): 13 to 15:14:17 to 21:18:14 to 16:15 to 18:12 to 16:12 to 13:3S6S3:2m. Sternal chaetotaxy of male essentially similar, but border setae somewhat more numerous; border setae on segments 4 to 12 of holotype as follows: 16:21:22:21:22:18:14:3S4S4:2m. As indicated there is a submedian pair of semitactile or short pseudotactile setae present in both sexes on sternite 11.

Male genitalic structures typical, as illustrated (fig. 5D); coxal sac relatively small, lacking a differentiated atrium and opening ventrally through a circular pore, which is situated near the median edge and at the bottom of a marked depression involving the anteromedian corner of the coxa (fig. 5E); fourth coxae with markedly rugose anterolateral spurs (fig. 5D, insert).

Female genitalic structures typical, as illustrated (fig. 5A); the well-developed median cribriform plates separate and distinct and occurring dorsally on the short but large-calibered tubule of the seminal receptacle just proximad of the point of terminal expansion (fig. 5A, insert).

Palps robust, tibia and femur markedly pedicellate; conspicuously, densely, and uniformly granulate on all surfaces and segments except for the ventral surfaces of the femur, tibia, and hand, and all surfaces of the fingers; only slightly differentiated sexually (fig. 4A–B); vestitural setae (except for fingers) very short and strongly clavate. Proportions of the male palp (holotype and paratype, respectively): trochanter 1.69 to 1.67 times as long as broad; femur 2.67 to 2.74 times as long as broad; tibia 2.58 to 2.62 times as long as broad; chela 2.85 to

2.94 (including pedicel 3.12 to 3.14) times as long as broad and 3.48 to 3.60 times as long as deep; hand distinctly broader than deep and much longer (1.29 to 1.30 times), as long as the short, stout fingers. Proportions of the female more robust than those of the male but not conspicuously so; proportions (observed range for three specimens including the allotype); trochanter 1.53 to 1.63 times as long as broad; femur 2.33 to 2.41 times as long as broad; tibia 2.22 to 2.36 times as long as broad; chela 2.50 to 2.69 (plus pedicel 2.69 to 2.94) times as long as deep; hand distinctly broader than deep and much longer (1.43 to 1.47 times) than the short, stubby fingers.

Chela with chaetotaxy, dentition, and sense spots as illustrated (fig. 4D, E); movable finger with setae SB and B absent, but with two pseudotactile setae (*a* and *b*) which occur submedially and subterminally on the finger in addition to setae T and B; marginal teeth well developed, contiguous, retroconical, and somewhat better developed in the female than in the male. Marginal teeth numbering 21 to 25 on the fixed, and 22 to 32 on the movable, finger of the female, and 24 to 25 on the fixed, and about 17 to 19 on the movable, finger of the male; tending towards reduction, obsolescence, and basal spacing in both sexes. Venom apparatus difficult to make out but apparently as indicated in figure 4E; the nodus ramosus about opposite the fifteenth to eighteenth marginal tooth (opposite seta IT on the fixed, and somewhat distad of seta T on the movable, finger). A few (two or three) sense spots occur basally both exteriorly and interiorly on either finger.

Legs robust, as illustrated (fig. 5J–O); granulosquamose and vestitured dorsally with short clavate setae; ventral setae acuminate; tarsal claws simple and untoothed (fig. 5P); subterminal setae dorsally monodentate (fig. 5N, P); third and fourth tarsi with a short, nearly terminal tactile seta (.94–.96 of dorsal length or .72–.75 of total length from the tarsal base; fig. 5K). Fore tarsus of male markedly specialized, swollen, and with a distinct terminal tarsal spine (fig. 5L); claws asymmetrically developed, the anterior (exterior) claw strongly curved and nearly normal; the posterior (interior) claw slender, acute, terminally nearly straight, parallel to the long axis of the tarsus and with a dorsal, tooth-like depression (fig. 5M, N).

Pedal proportions (both sexes unless otherwise indicated). Leg I: "miofemur" 2.39 to 2.48 times as long as deep; tibia

2.57 to 2.74 times as long as deep; tarsus of male 2.71 to 2.98 times as long as maximum depth; tarsus of female 3.44 to 3.49 times as long as deep. Leg IV: "miofemur" 2.70 to 2.82 times as long as deep; tibia 3.57 to 3.73 times as long as deep; tarsus of male 3.90 to 3.94 times as long as deep, of female 3.63 to 3.76 times as long as deep.

MEASUREMENTS (MM.): Male (holotype and paratype 252.-04001, respectively): Total length 2.89–2.98. Abdominal breadth 1.43–1.48. Carapace: .90–.86 long; ocular breadth .48–.49; posterior breadth 1.07–1.05; ocular disk .48 long; median disk .25–.23 long; posterior disk .16–.15 long; cucullus .082–.066 long; ocular diameter .082. Palps: trochanter .443 by .262–.266; femur .823–.817 by .308–.298; tibia .787–.786 by .305–.300; chela 1.140–1.151 (plus pedicel 1.246–1.230) by .400–.392 broad and .328–.320 deep; hand .667–.682 long; fingers .517–.525 long. Leg I: "miofemur" .481–.479 by .194–.198; tibia .349–.366 by .136–.140; tarsus .339–.358 by .125–.120; minimum(basal) depth of tarsus .077–.081. Leg IV: "miofemur" .738–.735 by .271–.262; tibia .558–.546 by .151–.147; tarsus .402–.390 by .103–.099; dorsal length of tarsus .309; tactile seta .296–.291 from base of tarsus and .132–.129 long.

Female [observed extremes and means (in parentheses) for three specimens including the allotype, and paratypes 252.04002 and 492.01001]: Total length: 3.18–3.80 (3.41); abdominal breadth 1.48–1.82 (1.67). Carapace: .82–.89 (.86) long; ocular breadth .46–.53 (.50); posterior breadth .98–1.08 (1.02); ocular disk .43–.51 (.48) long; median disk .25–.26 (.26) long; posterior disk .13–.15 (.14) long; cucullus .066–.082 (.077) long; ocular diameter .066–.082 (.074). Palps: trochanter .407–.426 (.418) by .238–.276 (.259); femur .712–.764 (.746) by .295–.328 (.314); tibia .695–.758 (.729) by .295–.331 (.317); chela .984–1.104 (1.048) [plus pedicel 1.058–1.205 (1.137)] by .394–.412 (.405) broad and .321–.336 (.331) deep; hand .597–.664 (.637) long; fingers .418–.462 (.441) long. Leg I: "miofemur" .423–.443 (.436) by .177–.180 (.179); tibia .315–.331 (.321) by .118–.121 (.120); tarsus .295–.307 (.302) by .085–.088 (.087). Leg IV: "miofemur" .672–.738 (.712) by .244–.269 (.258); tibia .492–.528 (.515) by .132–.147 (.141); tarsus .346–.380 (.367) by .094–.103 (.099); dorsal length of tarsus .265–.294 (.282); tactile seta .250–.283 (.270) from base of tarsus and .129–.144 (.134) long.

REMARKS: This interesting and unusual species is dedicated to my son, David C. Chamberlin, who "likes pseudoscorpions."

The holotype of this species exhibits one of the most unusual abnormalities yet observed in the Order Chelonethida. The movable finger of the left chela of this specimen is greatly reduced, being only half the normal length. The fixed finger is apparently completely normal. This abnormal chela, in comparison with the normal chela, is shown in figure 4D–E. No comparable abnormality has previously been reported for any of the Chelonethida.

OCALACHELIFER, NEW GENUS

GENEROTYPE (ORTHOTYPE): *Ocalachelifer cribratus*, new species.

DISTRIBUTION: United States of America, Florida.

DIAGNOSIS: (Based on male only; female unknown.) Cheliferine genus of slender proportions but typical facies, the male unique in possessing a prominent sclerotic, cribrate area in the atrial region of the coxal sac.

Carapace granular; with corneate eyes; two well-developed transverse furrows and denticuloclavate vestitural setae. Posterior disk lacking lateral crests.

Abdomen ovate, of usual facies; granulate or granulosquamose; vestitural setae denticuloclavate. Tergites more or less biseriate with about six discal and 10 to 15 marginal setae; tergites 1 to 3 medially depressed but not divided, 4 partially divided, 5 to 11 completely divided by linear membranous stripe; tactile setae apparently lacking on terminal segments although a submedian pair may possibly occur on tergite 11. Tergal crests of male reduced, vestigial, and scarcely apparent. Pleural area more or less armored by downturned margins of tergites. Pleural membrane somewhat hispidously striate or plicate; not smoothly plicate.

Sternites squamotessellate, scarcely roughened; vestitural setae simple and acuminate anteriorly, thickened and somewhat denticular to weakly clavate posteriorly. Sternite 4 impressed but not divided; sternites 5 to 11 completely divided by linear membranous stripe. Chaetotaxy uniseriate, with about 10 or 12 marginal setae. Sternites 10 and 11 with a submedian pair of semitactile or pseudotactile setae, which are relatively short on sternite 10 but longer and more slender on 11.

Coxal area of usual facies; evenly granulate on all surfaces;

vestitural setae acuminate; fourth coxae of male modified, with reduced and inconspicuous lateral spurs and with a moderately developed, highly specialized coxal sac, which opens to the exterior through a minute pore situated at the apex of a slender, translucent, "spine-like" papilla or process. Coxal sac with reduced, heavily sclerotic cribrate area and with numerous internal "setae" (fig. 6J, K, N).

Genital structures of male more or less typical but with the statumen convolutum only shallowly invaginated and lacking the usual median process (fig. 6F); ramshorn organs present and normal; general appearance of genitalia as illustrated (fig. 6M).

Chelicerae of usual facies; chaetotaxy normal; setae *sb* and *b* short, robust, and terminally more or less denticulate (fig. 6B); flagellum three bladed, anterior blade only dentate.

Palps attenuate, granular in all surfaces except fingers; vestitural setae thickened and terminally denticulate to weakly denticuloclavate. Chela with normal chaetotaxal pattern (fig. 6I); seta IT close to, but distinctly caudad of, ET; IST and EST submedian and closely approximate; T and ST submedian in position and well separated from SB and B. Venom ducts elongate, the nodus ramosus only a little distad of median.

Legs normal; granulate to granulosquamose; vestitural setae thickened and terminally denticulate to denticuloclavate dorsally, acuminate ventrally; tarsal claws simple and untoothed; subterminal setae acuminate. Male fore tarsus scarcely modified, lacking a terminal spine, with distinctly asymmetrical, curved fore claws, which may be more or less toothed ventrally (fig. 6O). Fourth tarsus with a short, terminal, tactile seta, which is closely associated with, or even opposite to, the more or less displaced apical setae.

Female: The female is unknown but should be characterized by simple claws, simple subterminal setae, and with the same chelal chaetotaxy as in the male. The probable character of the median cribriform plates is doubtful, probably paired but possibly fused.

Remarks: The systematic position of this genus is somewhat uncertain, in the absence of the female, owing to certain structural peculiarities of the male genitalia (i.e., the shallowly incised statumen convolutum which also lacks the usual median process) and the sclerotic, cribrate character of the coxal sacs, which are distinctive and quite different from any previously described. If

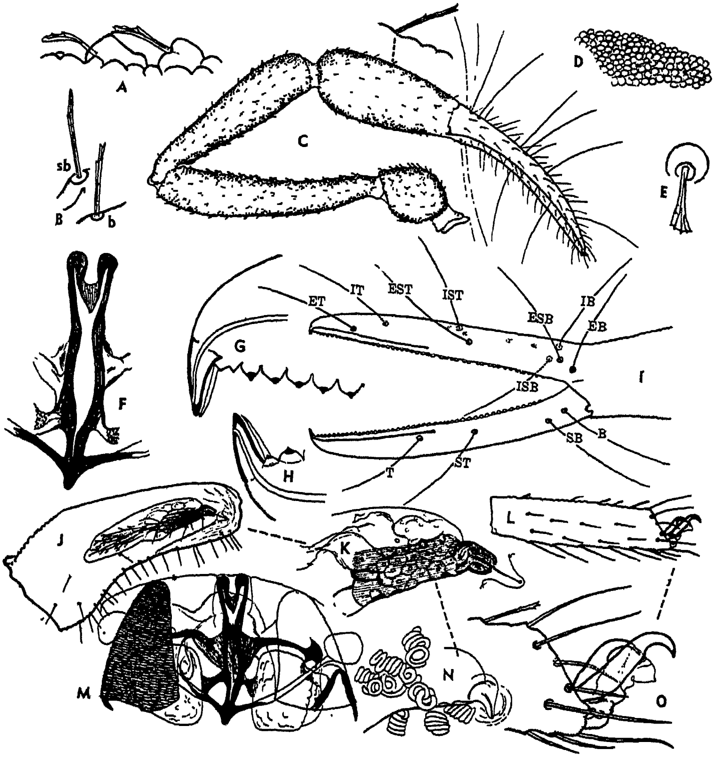

FIG. 6. *Ocalachelifer cribratus*, new species (all drawings from holotype except as noted). A. Vestitural setae and granulations from inner margin of palpal femur. B. Subbasal and basal setae of chelicera. C. Ventral aspect of right pedipalp. D. Detail of dermal sculpturation. Ventral surface of hand of chela. E. Denticuloclavate tergal seta. F. Statumen convolutum of male genitalia. G. Venedens and lamina defensor of fixed finger. H. Venedens and lamina defensor of movable finger. I. Exterior aspect of chela showing venom apparatus, chaetotaxy, and dentition. J. Fourth coxa of male showing coxal sac. K. Cribrate area of coxal sac. L. Fore tarsus of male. M. Male genitalic structures. N. Tubule-like structures of unknown significance found adjacent to cribrate area of coxal sac. O. Male praetarsus of leg I showing asymmetrical fore claws, acuminate subterminal setae, and arolium.

correctly placed (in the Cheliferini) it is close to *Idiochelifer*. Only the type species can currently be assigned to the genus.

Ocalachelifer cribratus, new species

Figure 6

MATERIAL: Holotype, male (JC-1494.02002); male paratopo-

type (JC-1494.02001). Both from the United States, Florida, Ocala National Forest, between Ocala and Umatilla, June 14, 1935. Coll. W. Ivie. Holotype in University of Utah collection. Paratype in collection of the American Museum.

DESCRIPTION: (Male only; female unknown.) An unusually small species of typical facies. Carapace slightly broader posteriorly than long; densely granulate over entire surface with scattered, larger setiferous tubercles, which are especially distinct laterally and posteriorly; vestitural seta sparse, short, moderately denticuloclavate; anterior furrow deeply grooved, slightly recurved medially, distinctly procurved laterally; posterior furrow deeply grooved, nearly transverse; eyes distinct, about their own diameter from the anterior margin.

All tergites distinctly granulate and sclerotic, laterally strongly deflexed, thus armoring much of the pleurum. Tergal crests scarcely evident, vestigial. Tergites 1 to 3 impressed but scarcely divided; tergite 4 partially divided, tergites 5 to 11 divided by linear, membranous stripe. Vestitural setae of tergites moderately denticuloclavate (fig. 6E); chaetotaxy:

$$8:11:10:10:10:\frac{5}{7}:\frac{6}{8}:\frac{5}{7}:\frac{4}{9}:\frac{3}{9}:\frac{1SS2}{7}:2m.$$

The presence of the submedian semitactile setae of tergite 11, as indicated in the foregoing formula, is doubtful (presence inferred on the basis of slightly enlarged areoles), the setae themselves being lost.

Coxal area typical, broadest across fourth coxae, granulate on lateral surfaces and squamosely tessellate ventrally. Fourth coxae typically recurved around genitalic structures, lateral spurs (fig. 6J) nearly vestigial. Coxal sacs relatively small, with numerous internal setae and with a prominent, ovate, heavily sclerotic, cribrate area mesoposteriorly. Coxal sacs further characterized by a peculiarly shaped, heavily sclerotic vestibule (reduced atrium ?) which opens to the exterior by means of a slender duct, which terminates in a minute pore at the apex of a slender, translucent, process or papilla (fig. 6J, K, N). Genital structures of male as illustrated (fig. 6F, M); statumen convolutum shallowly incised and lacking a median process; ramshorn organs normal.

Sternites squamotessellate, nearly smooth; sternite 4 entire; sternites 5 to 11 divided by a longitudinal, linear membranous stripe. Vestitural setae short and acuminate on all but sternites

9 to 11, where they are thickened and minutely denticulate to slenderly clavate. Chaetotaxy (segments 3–12):

$$(0)\,\frac{4}{12}:(0):(1)8(1):10:10:11:10:9:3S2S3:2T2T2:2m.$$

Chelicerae of usual facies; flagellum three bladed, anterior blade with about six subterminal unilateral teeth, the other blades simple; galea small, short, slender, and weakly curved, vestigially branched (the galea is probably sexually dimorphic, with short but well-developed terminal and subterminal branches in the female). Serrula exterior with 16 ligulate teeth, of which the basal one is longer than the others and terminally acute. Well-developed, subapical lobe present, which is subdivided into two small triangular sub-lobes (sub-lobes visible only from certain aspects). Chaetotaxy normal, no accessory setae; setae *sb* and *b* (fig. 6B) short, thickened, and terminally and subterminally microdenticulate.

Palps (fig. 6C) slender, evenly granulate on all segments and surfaces (dorsal and ventral) except for fingers; vestitural setae (fig. 6A) short, sparse, thickened, and terminally and subterminally minutely denticulate to moderately denticuloclavate (especially on inner face of trochanter, femur, and tibia). Trochanter with a rounded dorsal protuberance; femur and tibia scarcely pedicellate, slenderly clavate. Palpal proportions (observed range in holotype and paratype specimen, respectively): trochanter 1.77 to 1.70 times as long as broad; femur 5.08 to 5.04 times as long as broad; tibia 4.07 times as long as broad; chela 4.94 to 4.97 (with pedicel 5.13 to 5.24) times as long as broad; hand 2.25 to 2.24 times as long as broad; fingers 1.29 to 1.28 times as long as hand.

Chela with chaetotaxy and dentition as illustrated (fig. 6I). Venom ducts elongate, more than one-third the length of the entire finger, the nodus ramosus situated about opposite the twenty-seventh to twenty-eighth marginal tooth of either finger (caudad of seta T on movable finger, much caudad of seta IT but distinctly distad of seta IST on fixed finger). Marginal teeth of chela tending to be somewhat weaker and non-contiguous on the basal half of both fingers; numbering 46 on the movable finger and 48 to 51 on the fixed finger.

Legs of typical facies, more or less squamosely granulate on all surfaces; vestitural setae denticulate; thickened to slightly

clavate on all parts, except ventrally on the tarsi of all legs and on the tibiae of legs 1 and 2, where they are acuminate. Tarsal claws normal, simple, and untoothed, subterminal setae simple and untoothed. Fourth tarsus with a short, terminal, tactile seta, the areole of which is nearly opposite one of the laterally displaced apical setae; tactile seta about one-third longer than the apical setae. Fore tarsus of male (fig. 6L, O) scarcely differentiated except for the asymmetrically developed claws. Both fore claws strongly curved, and each with a small ventral tooth or "tooth-like" process about medially, the development of this tooth variable; posterior claw distinctly much smaller than the anterior claw (fig. 6O).

Pedal proportions (observed range in holotype and paratype, respectively). Leg I: "miofemur" 3.04 to 3.34 times as long as deep; tibia 3.28 to 3.26 times as long as deep; miotarsus 4.42 to 4.33 times as long as deep. Leg IV: "miofemur" 3.08 to 2.94 times as long as deep, tibia 4.29 to 4.39 times as long as deep, miotarsus 4.59 to 4.90 times as long as deep. Tactile seta of fourth tarsus .99 of dorsal (.80 to .76 of total) tarsal length from the base of the segment.

Measurements (mm.): Holotype and paratype, respectively: Total length 1.98–1.95. Abdominal breadth .98–.95. Carapace: .72–.71 long; ocular breadth .38–.39; posterior breadth .74–.77; ocular disk .34 long; median disk .26–.27 long; posterior disk .12–.10 long. Lengths of tergites 1 to 6, inclusive: .12–.10; .12–.10; .10–.10; .10–.10; .11–.11; .12–.12. Cucullus .071–.085 long. Ocular diameter .071–.082. Palps: trochanter .399–.392 by .226–.230; femur .859–.836 by .169–.166; tibia .777–.749 by .191–.184; chela 1.279–1.248 (plus pedicel, 1.330–1.315) by .259–.251; hand .582–.563 long; fingers .748–.718 long. Length of venom duct .303–.312. Leg I: "miofemur" .456–.454 by .148–.136; tibia .321–.313 by .098–.096; miotarsus .318–.312 by .072. Leg IV: "miofemur" .607–.579 by .197; tibia .459–.443 by .107–.101; miotarsus .344–.353 by .075–.072. Dorsal length of fourth miotarsus .280–.272; tarsal tactile seta .276–.269 from base of tarsus and .088–.092 long.

Remarks: The peculiar cribrate coxal sacs constitute one of the most interesting and unique features of this species, which is also among the smallest known Cheliferinae. In the paratype specimen the coxal area was not cleared and stained, and in this specimen the cribrate area of either coxal sac seems to be surrounded

by a mass of slender, peculiarly coiled, tubule-like structures, which are sketched in figure 6N. The nature of these "tubules" is uncertain, and they may not actually be a normal part of the coxal structure. Nothing comparable has been observed in specimens of any other species. They appear to be confined to the coxal cavity itself and do not seem to occur in the coxal sacs proper, although it is difficult to be certain of this.

TRIBE **DACTYLOCHELIFERINI** BEIER

Rhacochelifer heterometrus (L. Koch)

Figure 7

Chelifer heterometrus L. Koch, 1873, Uebersichtliche Darstellung der europaischen Chernetiden Nurnberg, p. 29.

Rhacochelifer heterometrus (L. Koch), Beier, Das Tierriech, 1932, vol. 58, p. 268.

Material: One female (JC-921.01001) identified as this species by V. Redikorzev, from whom the specimen was secured in exchange. It was collected by E. Kiritshenko at the roots of a *Euphorbia* on September 2, 1927, at Kikeneis in the Crimea (U.S.S.R.).

Diagnosis: Large species with extremely robust, chernetoid palps. Carapace evenly granulate, somewhat longer than posteriorly broad, with two transverse furrows; anterior furrow caudad of median; median disk scarcely longer than sclerotized portion of posterior disk; posterior lateral corners of carapace non-sclerotic. These non-sclerotic areas of the carapace triangular in shape and defined by line drawn from lateral margin of carapace at origin of anterior furrow and extending to posterior margin of carapace at a point about one-fourth of posterior breadth of carapace from its margin. Sclerotic portion of carapace broadest at anterior furrow. Two corneate eyes present, which are slightly more than their own diameter from the anterior carapacal margin. Vestitural setae short, slightly thickened, minutely denticulo-acuminate.

Tergite 1 entire; tergites 2 to 11, inclusive, longitudinally divided by a linear stripe. Sclerotic area of individual scuta squamotessellate, rectangular, about twice as broad as long, and with a subcentral darker spot; delimited posteriorly by the marginal setae. Tergites biseriate in part; chaetotaxy:

$$12:12:12:\frac{6}{9}:\frac{6}{9}:\frac{6}{10}:\frac{6}{11}:\frac{6}{9}:\frac{5}{11}:\frac{6}{11}:\frac{8}{6}:2\text{m}.$$

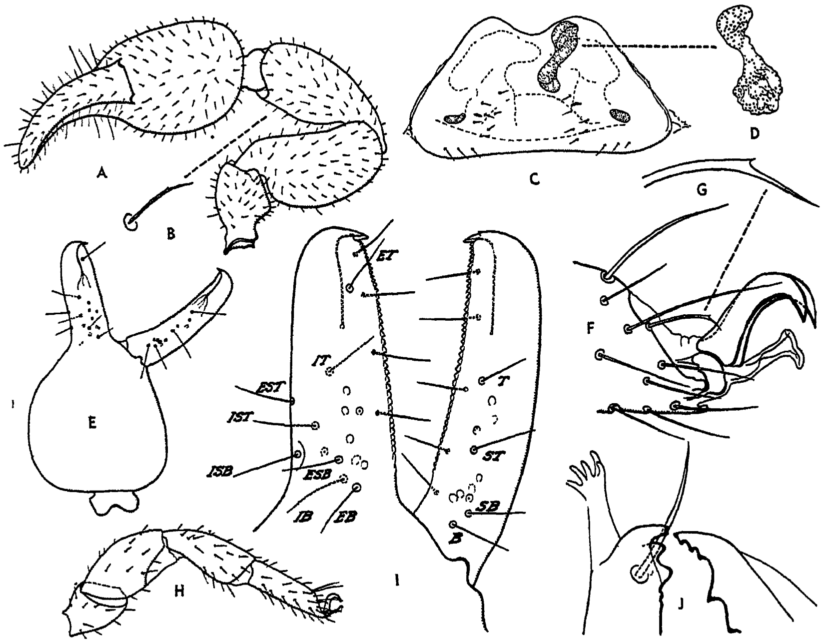

FIG. 7. *Rhacochelifer heterometrus* (L. Koch). A. Ventral aspect of left palp. B. Vestitural seta from tibia. C. Female genital area showing spermatic receptacles and cribriform plates. D. Median cribriform plate. E. Exterior aspect of right chela. Same scale as figure A. F. Fourth praetarsus showing arolium and claws. G. Subterminal tarsal seta. H. Fore leg. I. Exterior aspect of fingers of chela showing chaetotaxy, venom apparatus, sense spots, and dental guard setae. J. Tip of chelicera showing galea, galeal seta, and subdivided subapical lobe.

Anterior setae of segment 11 elongate, semi-tactile. Vestitural setae as on carapace, short, somewhat thickened, and terminally minutely denticulo-acuminate. Pleural membrane non-rugose and almost evenly plicate. Sternites similar to tergites but more nearly smooth, the tessellations less prominent; all sternites including the eleventh longitudinally divided; vestitural setae short and acuminate; chaetotaxy (segments 3 to 12):

$$(0)15(0):(1)11(1):11:15:13:\frac{2\text{-}0}{12}:\frac{2\text{-}0}{14}:\frac{2\text{-}0}{14}:\frac{\text{TT}}{1\text{T}5\text{T}1}:2\text{m}.$$

Eleventh tergite and sternite with abundant scattering of microlyrifissures, especially caudally (peri-anally).

Genital area of female as illustrated; lateral cribriform plates distinct, elliptical in shape; median cribriform plates fused into a single, somewhat dumbbell-like plate, as illustrated (fig. 7C, D).

Chelicerae small, of normal facies; subapical lobe of movable finger divided into two prominent sublobes or teeth (fig. 7J); galea short, robust, and with five terminal, slightly recurved, simple branches; chaetotaxy of palm of chelicera normal; setae *sb* and *b* short and acuminate but with one or two minute subterminal denticles; movable finger with three subapical microdenticles and three spaced, slightly retrorse median teeth; serrula exterior with 25 blades, of which the basal one is elongated and terminally pointed; velum of serrula interior with a slender dentate terminal process and three dentate subapical lobes.

Palps (fig. 7A) extremely robust, all segments prominently pedicellate and chernetoid in appearance, evenly granular on all surfaces, except for the fingers which are smooth; vestitural setae short and denticulo-acuminate. Trochanter with rounded but relatively inconspicuous dorsal and posterior protuberances, 1.95 times as long as broad; femur slightly broadest subbasally, almost as long as tibia and 2.18 times as long as broad; tibia with pedicel not differentiated posteriorly; 1.99 times as long as broad; chela excessively robust, much deeper than broad and with strongly curved fingers, 2.26 (with pedicel 2.43) times as long as broad and 1.78 (plus pedicel 1.94) times as long as deep; fingers longer than breadth of chela, but scarcely as long as its depth; hand distinctly longer than apparent length of fingers from a ventral aspect, but scarcely longer than fingers as viewed from a lateral aspect.

Chela as illustrated (fig. 7E, I); tactile setae unusually short but areoles well differentiated; fixed finger with 38, movable finger with 41, marginal teeth; interiorly with a series of evenly spaced, very robust paradental guard setae, which number five on the movable and four on the fixed finger, respectively (shown in fig. 7I). Chaetotaxy and venom apparatus as illustrated; nodus ramosus about opposite marginal tooth 18 or 19 in both cases. Sense spots occur on the fingers exteriorly and interiorly. Fixed finger with six spots exteriorly between EB and a point opposite EST; interiorly with a single median spot about opposite IST and another subbasally between IST and ISB. Movable finger exteriorly with four spots between ST and SB and two between T and ST; interiorly with two spots, one submedian, the other subbasal.

Legs short and robust (fig. 7H). Tarsal claws acute, non-toothed; subterminal seta dorsally monodentate (fig. 7F, G). Leg IV lacking a tactile seta, although a short (much shorter than tarsal breadth) denticulate seta, which is slightly longer than usual, occurs proximad of the apical setae and distad of median. Legs faintly but clearly squamotessellate, the vestitural setae dorsally short and denticulo-acuminate, ventrally simple and acuminate. Leg I: "miofemur" 2.44, tibia 2.42, and miotarsus 3.37, times as long as deep. Leg IV: "miofemur" 2.61, tibia 2.96, and miotarsus 3.10, times as long as deep.

MEASUREMENTS (MM.): Female: Total length (KOH expanded) 6.46. Carapace: 1.28 long; .69 broad across eyes; 1.20 broad posteriorly; 1.07 broad medially (at anterior furrow); median sclerotic portion of posterior disk .85 broad; ocular disk .76 long; median disk .25 long; posterior disk .21 long; cucullus .115 long; ocular diameter .098. Dorsal length of abdominal segments 1 to 6: .16, .20, .18, .26, .30, .30. Palps: trochanter .705 by .372; femur .992 by .456; tibia 1.017 by .510; chela 1.706 (plus pedicel 1.837) by .754 broad and .958 deep; hand .935 long; fingers .787 long (ventral aspect). Chela from lateral aspect 1.706 (plus pedicel 1.886) long; hand .869 long; movable finger .836 long; venom duct .24–.25 long. Leg I: "miofemur" .640 by .262; tibia .476 by .197; miotarsus .476 by .141. Leg IV: "miofemur" 1.181 by .443; tibia .787 by .266, miotarsus .549 by .177.

REMARKS: The basis of Redikorzev's identification of this specimen with Koch's *Chelifer heterometrus* is not known. The specimen at hand agrees substantially with Koch's imperfect description as far as the latter goes. The whereabouts of Koch's types is unknown; they were apparently inaccessible to Beier, who recognized the species as a *Rhacochelifer* but added nothing to its description and did not include it in his keys. This is apparently the first published record of this species from other than the type material, which was stated by Koch to have been discovered in "Syra [= Syria ?] by Herrn. Erber." Beier gives its "distribution" as "Islands of the Aegean Sea."

This is a remarkable species in many ways. The general appearance of the palp and chela is closely similar to that of certain male Chernetidae of the genus *Dinocheirus*. It is an interesting example of structural parallelism in non-related forms.

Macrochelifer tibetanus (Redikorzev)

Figure 8

Chelifer tibetanus REDIKORZEV, 1918, Ann. Mus. St. Petersbourg, vol. 22, p. 93, fig. 2 (palp and chelicera).

Hysterochelifer tibetanus (Redikorzev) BEIER, 1932, Das Tierreich, vol. 58, p. 234, fig. 242 (palp).

Macrochelifer tibetanus (Redikorzev) VACHON, 1940, Bull. Mus. Hist. Nat. Paris, ser. 2, vol. 12, no. 7, pp. 412–414. (Species designated the orthotype of *Macrochelifer*, new genus.)

MATERIAL: A single female cotype (JC-904.01001) received in exchange from V. Redikorzev. Labeled as follows: "*Chelifer tibetanus* Redikorzev, Thibet, Northern shore of Lac Tosso-nor, Tsaidam River, VI. 1901. Thibet Expedition. Female cotyp!" The original collection comprised four males and two females.

DIAGNOSIS (ADDENDA): Female: Carapace about as broad as long; with the usual two transverse furrows and well-developed corneate eyes, which are slightly more than their own diameter from the carapacal margin; surface evenly granulate; vestitural setae short and denticulo-acuminate. The abdominal chaetotaxy not observable in my material. Pleural membrane of abdomen smooth, or nearly so, and more or less evenly plicate. Tergites squamotessellate. Tergites 1 to 10 divided; 11 entire, transverse. Sternites 4 to 10 divided, 11 entire. Tergal and sternal divisions linear. Both dorsal and ventral anal opercula bisetose.

Genital area typical of tribe, the median cribriform plates fused into a complex, lobed central structure as illustrated (fig. 8A, B.)

Chelicerae of normal facies; flagellum of three blades; galea broken in present specimen, but illustrated by Redikorzev as short and weakly branched (sex ?); serrula exterior reported to comprise 21 blades (not observable in present specimen); subapical lobe small, entire; chaetotaxy of palm with the usual complement of setae (*ls*, *is*, *sb*, *b*, and *es*) plus a single accessory seta situated between *es* and *sb* (the seta itself lost in my preparation but the areole is distinct); seta *es* is unusually long and slender (Redikorzev's illustration of the chelicera apparently omits seta *b* but shows the accessory seta above noted as slender, about as long as seta *sb* but clearly shorter than *es*).

Palps slender; trochanter, femur, tibia, and inner face of chela evenly granulate; balance of palps smooth; vestitural setae

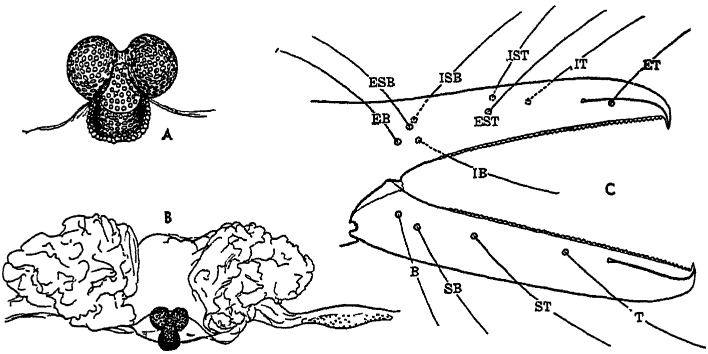

FIG. 8. *Macrochelifer tibetanus* (Redikorzev) (drawings from female "cotype," specimen JC-904.01001). A. Median cribriform plate. B. Genitalic structures of female showing median and lateral cribriform plates. C. Exterior aspect of right chela showing chaetotaxy, dentition, and venom apparatus.

very short and denticulo-acuminate. Trochanter 2.04 times as long as broad; femur distinctly longer than tibia and 4.01 times as long as broad; tibia 3.34 times as long as broad; chela 3.94 (including pedicel 4.22) times as long as broad; hand somewhat broader than deep and 1.16 times as long as the fingers.

Chela with chaetotaxy and dentition as illustrated (fig. 8C); fixed finger with 45, movable finger with 49, marginal teeth; venom ducts with nodus ramosus opposite the sixteenth to seventeenth marginal tooth; sense spots sparse or nearly absent, only two being noted exteriorly on the movable finger, one opposite seta T, and one slightly distad of seta ST.

Legs slender, the tarsi broader distally than proximally; subterminal seta acuminate; tarsal tactile seta apparently lacking ("teste" Vachon; all such setae lost from my specimen). Leg I: "miofemur" 3.58 times as long as deep; tibia 4.34 times as long as deep; miotarsus 5.19 times as long as deep. Leg IV: "miofemur" 5.18 times as long as deep; tibia 6.52 times as long as deep; miotarsus 5.43 times as long as deep.

MEASUREMENTS (MM.): Female cotype: Total length (KOH expanded) 6.59; abdomen 3.0 broad. Carapace: 1.54 long; ocular breadth .62; posterior breadth 1.48; ocular disk .72 long; median disk .49 long; posterior disk .33 long; cucullus .118 long; ocular diameter .098. Length of tergal segments 1 to 6, inclusive: .33, .33, .36, .30, .39, .49, and .54. Palps: trochanter .817 by .400; femur 1.591 by .397; tibia 1.381 by .413; chela

2.247 (plus pedicel, 2.411) by .571 broad and .500 deep; hand 1.246 long; fingers 1.074 long; venom duct of chela .243 long. Leg I: "miofemur" .968 by .271; tibia .705 by .162; miotarsus .656 by .118 basally and .125 subterminally. Leg IV: "miofemur" 1.528 by .295; tibia 1.261 by .194; miotarsus .820 by .136 basally and .151 subterminally.

MALE: As described by Vachon, the male lacks coxal sacs; the tergal keels are lacking; the male genitalia are medially invaginated but lack the median, rod-like process characteristic of most Cheliferini.

REMARKS: As pointed out by Vachon, this species was improperly assigned to *Hysterochelifer* by Beier and, indeed, seems properly to pertain to the Dactylocheliferini. The tarsi of this species are unusual, being distinctly broader terminally or subterminally than basally (see measurements).

Hansenius spinosus, new species

Figure 9

MATERIAL: Holotype, female (JC-205.01001), Africa, Belgian Congo, Zambi, June, 1915. Received for determination from R. V. Chamberlin. No other material known. Holotype in University of Utah collection.

DIAGNOSIS: (Female only.) Carapace vestitured with prominently denticuloclavate setae; distinctly and evenly granulate, but with many scattered setiferous spines or tubercles, especially laterally and anteriorly; with two corneate eyes situated about one ocular diameter from the anterior margin; anterior furrow deeply grooved, medianly recurved, laterally procurved; posterior furrow well defined and about a tergal length from the posterior margin; posterior disk with a distinct median furrow continuous with the tergal divisions of the abdomen; bordered by about 12 clavate setae.

Abdomen normally ovate; first four tergites distinctly "shortened," the third medially less than half as long as one of the median tergites; all tergites and sternites (including 11) longitudinally divided by a narrow stripe or suture; biseriate; tergal chaetotaxy:

$$\frac{10}{14}:\frac{10}{14}:\frac{10}{14}:\frac{11}{14}:\frac{11}{16}:\frac{10}{20}:\frac{10}{25}:\frac{10}{20}:\frac{10}{17}:\frac{10}{17}:\frac{8}{14}:2\text{m}.$$

Scuta of tergites 4 to 10 with a central darker spot; squamosely

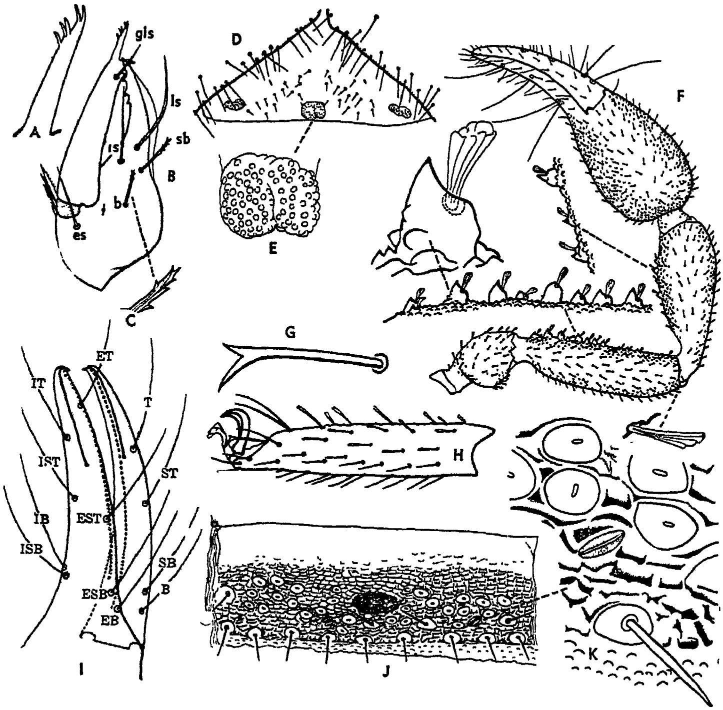

FIG. 9. *Hansenius spinosus*, new species (all drawn from female holotype). A. Galea. B. Chelicera. C. Tip of subbasal seta of chelicera. D. Genital area showing chaetotaxy and cribriform plates. E. Median cribriform plate. F. Ventral aspect of left palp. Inserts: details of structure of setiferous tubercles or spines and vestitural setae. G. Subterminal seta. H. Fourth tarsus. Note absence of tactile seta. I. Subdorsal aspect of right chela showing chaetotaxy, venom ducts, and dentition. J. Right half of eighth sternite showing chaetotaxy, dermal sculpturation, and discal zone of "collared" microlyrifissures. K. Detail of dermal sculpturation, "collared" microlyrifissures, and seta:

tesselate; vestitural setae broadly clavate and inserted in large and conspicuous, non-sculptured areoles. Sternites finely squamosely tessellate; sternites 8 to 11 beset by slenderly clavate setae, the others with simple setae. Sternites obscurely biseriate; chaetotaxy (segments 2 to 12):

$$(27):(0)8(0):(1)10(1):\frac{7}{16}:\frac{7}{15}:\frac{7}{17}:\frac{10}{16}:\frac{8}{18}:\frac{5}{17}:\frac{1TT1}{12}:2m.$$

Sternites 5 to 10 characterized by an irregular transverse zone of about 50 to 60 microlyrifissures which occupies the posterior

half of each of the sternites, the anterior half smooth and almost completely non-tessellate (fig. 9J); the individual microlyrifissures each occupy the center of a smooth sclerotic plate the size of a normal seta areole and quite as distinct (fig. 9K). A slender submedian pair of acuminate tactile setae occurs on the disc of sternite 11. No other abdominal tactile setae. Pleural membrane generally smooth, irregularly and sinuately plicate.

Genital area of typical dactylocheliferine facies; median cribriform plate medium in size and subcircular (fig. 9D, E).

Chelicerae of usual facies (fig. 9B); flagellum of three blades, the anterior one of which is laterally minutely denticulate; setae *sb* and *b* of chelicera short; stout and terminally denticulate (fig. 9C); serrula exterior with 18 ligulate blades; galea slender, with five very short, slightly recurved terminal and subterminal branches (fig. 9A).

Palps (fig. 9F) moderately robust, of usual cheliferine facies, except that the basal half of the anterior face of the femur bears a close series of eight large setiferous tubercles (fig. 9F, inserts), which are as "high" as the length of the ordinary palpal seta. The tibia bears in the middle of its anterior face three or four such tubercles, while the heel of the trochanter is crowned by two or three more. Aside from these the palps are smoothly and evenly granulate, except for the fingers of the chela and the ventral surface of the femur, tibia, and hand, which are nearly or quite smooth. Vestitural setae of palps clavate to stout and thick (fig. 9F). The setiferous tubercles bear the seta areole about halfway to the spine-like apex which, in turn, reaches halfway to the tip of the strongly clavate seta. Palpal proportions (exclusive of larger setiferous tubercles): trochanter 1.86 times as long as broad; femur subequal to, or slightly longer than, tibia, distinctly shorter than the carapace and 3.62 times as long as broad; tibia 2.92 times as long as broad; chela 3.03 (plus pedicel 3.21) times as long as broad; hand and fingers subequal in length; hand 1.6 times as long as broad.

Chaetotaxy of chela as illustrated (fig. 9I); marginal teeth of fixed finger number 46; of movable finger, 48. A few sense spots may occur on the fingers of the chela, but they are not distinct.

Legs of usual facies; tarsal claws simple and untoothed; fourth tarsus (fig. 9H) completely lacking a tactile seta or sense dome; subterminal tarsal seta slightly curved distally and with a single prominent, dorsal tooth (fig. 9G). Leg I: "miofemur" 3.03

times as long as deep; tibia 3.18 times as long as deep; miotarsus 4.89 times as long as deep. Leg IV: "miofemur" 2.33 times as long as deep; tibia 3.88 times as long as deep; miotarsus 4.84 times as long as deep.

MEASUREMENTS (MM.): Female, holotype: Total length 2.69. Abdominal breadth about 1.4. Carapace: .94 long; ocular breadth .46; posterior breadth about .9; anterior disk .45 long; median disk .32 long; posterior disk .16 long; cucullus .069 long; ocular diameter .082. Length of tergites 1 to 6: .13, .12, .08, .10, .15, .20. Palps (measurements exclusive of larger tubercles): trochanter .499 by .269; femur .879 by .243; tibia .861 by .295; chela 1.392 (plus pedicel 1.476) by .459; hand .738 long; fingers .741 long. Leg I: "miofemur" .531 by .175; tibia .394 by .107; miotarsus .362 by .074. Leg IV: "miofemur" .771 by .331; tibia .574 by .148; miotarsus .436 by .090.

REMARKS: This species is closely related to *Hansenius mirabilis* Beier (1933, Ann. Mag. Nat. Hist. ser. 10, vol. 11, pp. 645–647). *H. mirabilis* is a strongly dimorphic species, the hand of the chela of the male being proportionally greatly expanded in comparison with that of the female. It seems probable that the same feature will be found to characterize the present species once the male becomes known.

In the females of *H. mirabilis* the hand is much longer than the fingers (about 1.4 times), while in the present species the hand and fingers are of subequal length.

GENUS **MICROCHELIFER** BEIER

Microchelifer BEIER, 1944, Eos, vol. 20, pp. 208–209.

GENEROTYPE (ORTHOTYPE): *Microchelifer vosseleri* Beier.

DISTRIBUTION: East Africa, India.

DIAGNOSIS (EMENDED): (Based on male only; female unknown.) Dactylocheliferine genus of typical facies but of unusually small size. Similar in many structural characteristics to *Dactylochelifer*.

Carapace longer than posteriorly broad; with corneate eyes; transverse furrows pronounced, deeply grooved; posterior disk lacking lateral crests. Vestitural setae relatively slender but more or less denticulate.

Abdomen moderately slender, normal in facies; tergites and sternites divided in part at least; tergite and sternite 11 separate,

undivided, and each apparently provided with at least a single lateral pair of tactile setae; anterior tergites provided with prominent lateral crests. Tergal setae slender, denticulo-acuminate; sternal setae acuminate; tergites and sternites uniseriate (except for the usual lateral discal setae on some segments); the marginal setae numbering about eight to 10 both dorsally and ventrally. Pleural membrane nearly smooth and longitudinally, finely plicate.

Male genital structures, including coxal sacs, of typical dactylocheliferine facies (fig. 10E, F).

Chelicera with three-bladed flagellum; setae *sb* and *b* transversely opposite; seta *b* terminally, minutely bifurcate or denticulate; all others acuminate; single galeal seta only; serrula exterior with about 12 to 15 ligulate blades.

Palps (fig. 10C) slender, of typical cheliferine facies; granulate in part; vestitural setae short, slender, denticulo-acuminate. Chela gaping (in *sadiya*, new species, at least); chaetotaxy as illustrated (fig. 10B); interior setae of fixed finger more or less clustered on basal half of the finger, IT about opposite EST; IST somewhat closer to IT than to ISB; seta ST closer to SB than to T; T distad of median and opposite nodus ramosus of venom apparatus.

Legs of typical structure. Male fore tarsus (fig. 10A) strongly modified (swollen), but lacking a terminal spine; tarsal claws asymmetrical. Claws of other legs untoothed, of typical form; subterminal seta dorsally monodenticulate; fourth tarsus (fig. 10D) with a long and slender submedian tactile seta (.53 of dorsal length and about .4 of total tarsal length from its base).

REMARKS: Known only from the orthotype and the present species. Female not known, but with little doubt characterized by essentially the same chelal chaetotaxy as the male, by simple tarsal claws, by dorsally monodenticulate subterminal setae, by a submedian tactile seta on the fourth tarsus, and by a fused, median, cribriform plate.

KEY TO RECOGNIZED SPECIES OF *Microchelifer* (MALES ONLY)

Femur 4.1, tibia 3.2, times as long as broad; exterior claw of fore tarsus with a distinct ventral tooth; fingers of chela with 35 to 38 marginal teeth; from India. . . . . *sadiya*, new species

Femur 4.5, tibia 3.9, times as long as broad; both claws of fore tarsus untoothed; fingers of chela with 25 to 28 marginal teeth; from East Africa . . . . *vosseleri* Beier

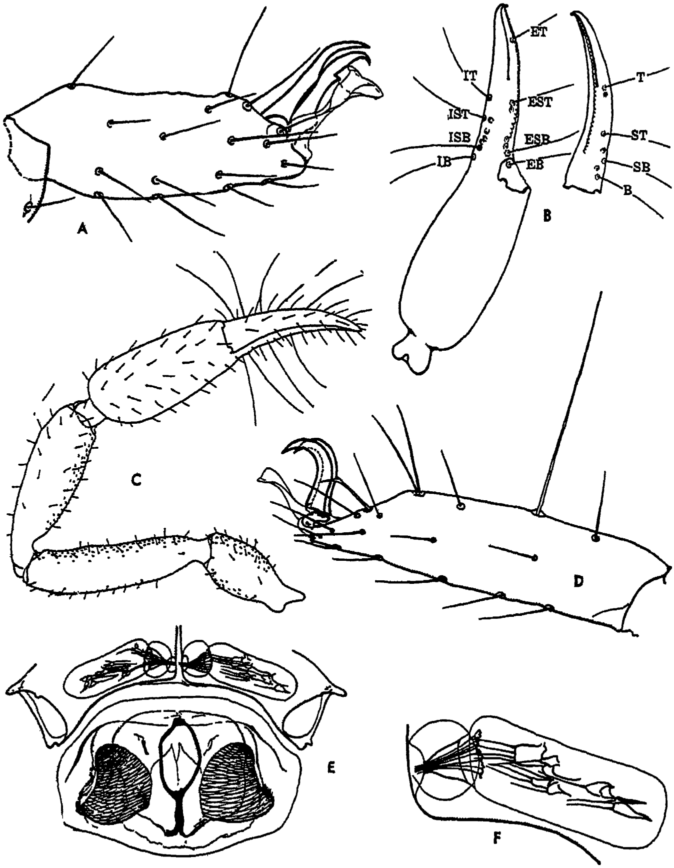

FIG. 10. *Microchelifer sadiya*, new species. A. Posterior aspect of right fore tarsus. B. Sublateral aspect of chela showing chaetotaxy, dentition, and venom apparatus. C. Ventral aspect of right palp. D. Posterior aspect of left fourth tarsus. E. Sketch of male genital structures, fourth coxae, and coxal sacs. F. Coxal sac.

Microchelifer sadiya, new species

Figure 10

MATERIAL: Holotype, male (JC-1071.25001). India, upper Assam, Atkel, Nazira. Coll. F. H. Wilson, 1910, "on a brick outside my bungalow." Specimen donated by H. W. Kew, to whom I wish to express my sincere appreciation.

DIAGNOSIS: General appearance typical of species of the subfamily Cheliferinae and of the tribe Dactylocheliferini, but re-

markable because of its small size, the total body length being less than 2 mm.

Carapace heavily sclerotic, the surface tessellate and smooth dorsally but becoming distinctly granulate laterally; somewhat longer than posteriorly broad; both furrows sharply defined (grooved) and transverse; eyes large, well developed, corneate, and about half their diameter from the anterior carapacal margin; vestitural setae slender and denticulo-acuminate.

Abdomen more than twice as long as the carapace, relatively slender; tergites 4 to 10 and sternites 4 to 10 completely divided by a linear suture; tergite and sternite 11 entire, transverse, and separate. Tergites 1 to 4 undivided and with distinct lateral crests; tergite 5 partially divided and with vestigial lateral crests; scuta weakly tessellate, nearly smooth; vestitural setae slender, denticulo-acuminate; tergal chaetotaxy (exclusive of the lateral discal setae which occur on tergites 3 to 9): 7:8:8:8:10:10:10: 10:8:8:T4T:2m. The lateral tactile setae of tergite 11 inferred from the size of the areoles, the setae themselves being lost from the type. Sternites nearly smooth; each bordered by eight to 10 slender, acuminate setae; anal segment with the usual pair of microsetae; sternite 11 with a lateral pair of tactile setae as on tergite 11.

Genital structure of male of typical dactylocheliferine type; statumen convolutum anteriorly rounded, not incised; ramshorn organs typical (fig. 10E); coxal sacs with prominently differentiated atrium (fig. 10F).

Chelicerae of typical facies; setae *sb* and *b* laterally opposite; *sb* acuminate; *b* terminally, minutely bifurcate; *es* longer than *b* or *sb;* serrula exterior with 13 ligulate teeth; galea long and slender with six or seven minute terminal branches.

Palps (fig. 10C) slender; trochanter and anterior face of femur and tibia finely granulate; vestitural setae slender and denticulo-acuminate. Trochanter with a moderate dorsal protuberance, 2.17 times as long as broad; femur pedicellate, broadest distally, 4.14 times as long as broad; tibia slender, broadest subterminally, 3.20 times as long as broad; chela with nearly parallel sides, equally swollen anteriorly and posteriorly, 3.98 (with pedicel 4.24) times as long as broad; depth and breadth of chela subequal; hand about twice as long as broad and as long as the fingers.

Chela as illustrated (fig. 10B); fixed finger with 36 or 37, mov-

able finger with about 35, marginal teeth. Proximal seven or eight marginal teeth of either finger reduced. Fixed finger interiorly with four sense spots between IST and ISB; interiorly with a couple of spots distad of ESB and another closely associated with EST; movable finger with a couple of spots close to SB. Interior setae clustered on basal half of fixed finger with seta IST about opposite EST. Nodus ramosus about opposite the nineteenth to twentieth marginal tooth on either finger.

Legs of typical facies. Leg I: "miofemur" 3.54 times as long as deep; tibia 2.66 times as long as deep; tarsus 2.86 times as long as deep. Fore tarsus (fig. 10A) thickened, lacking a terminal spine; claws asymmetrical, the posterior (exterior) claw slender and untoothed; the anterior claw more strongly curved and with a stout, median, ventral tooth. Leg IV: "miofemur" 3.07 times as long as deep; tibia 3.77 times as long as deep; tarsus 4.17 times as long as deep. Fourth tarsus (fig. 10D) with simple acuminate claws of the usual form; subterminal seta dorsally monodenticulate; with a long and slender median tactile seta, situated .53 of dorsal length (base to apical setae) and .38 of total tarsal length from its base.

Measurements (mm.): Male holotype: Total length 1.86. Abdomen .74 broad. Carapace: .55 long; ocular breadth .26; posterior breadth .47; ocular disk .25 long; median disk .21 long; posterior disk .09 long; cucullus .033 long; ocular diameter .062. Length of tergites 1 to 6, inclusive: .098, .087, .090, .098, .118, and .120. Palps: trochanter .287 by .132; femur .476 by .115; tibia .464 by .145; chela .733 (plus pedicel .781) by .184 broad and .182 deep; hand .377 (plus pedicel, .389) long; fingers .377 long. Venom duct .155 long. Leg I: "miofemur" .326 by .092; tibia .202 by .076; miotarsus .180 by .063. Leg IV: "miofemur" .418 by .136; tibia .298 by .079; miotarsus .217 by .052. Tactile seta of tarsus IV .144 long and situated .082 from base of segment.

Remarks: This species is of unusual interest as it is the smallest representative of the family Cheliferidae yet known.

TELECHELIFER, NEW GENUS

Generotype (orthotype): *Telechelifer lophonotus*, new species.

Distribution: Ceylon (possibly doubtful).

Diagnosis: (Based on male only, female unknown.) Dactyl-

ocheliferine genus of unique facies owing to the prominent lateral crests developed on the median, as well as on the posterior, disk of the male carapace.

Carapace (fig. 11F) nearly smooth, weakly tessellate laterally; with corneate eyes; with two equally prominent transverse grooves or furrows; median disk constricted posteriorly and provided with lateral crests; posterior disk tergiform and also provided with lateral crests or keels; vestitural setae slender and finely denticulo-acuminate.

Abdomen ovate, of usual facies; tergites 11 and sternites 10 and 11 each with a pair of tactile setae; anterior tergites of male with prominent lateral crests; tergites and sternites more or less clearly divided in part by a longitudinal suture; tergite and sternite 11 entire, transverse and separate; tergites and sternites uniseriate except for lateral discal setae on some segments; marginal setae of tergites slender and denticulo-acuminate, numbering about 16 per segment; sternal setae acuminate and numbering about 16 to 18 per segment. Tergites nearly smooth; weakly tessellate. Pleural membrane smooth and evenly longitudinally striate.

Male genital structure typical of Dactylocheliferini; ramshorn organs well developed; general appearance as sketched (fig. 11A). Fourth coxa unusually broadened and with pronounced lateral spurs; coxal sacs large; atrium well developed, anteriorly at least (fig. 11E).

Chelicerae of normal facies; chaetotaxy normal, no accessory setae; character of setae *sb* and *b* not ascertainable (lost from only known specimen of orthotype). Serrula exterior with about 16 to 18 ligulate teeth.

Palps slender but chela unusually large in proportion to the proximal segments (fig. 11H); trochanter, femur, and tibia finely granulate, in part at least.

Chela of male markedly gaping (fig. 11I); chaetotaxy and dentition as illustrated (fig. 11G, I, L). Seta ET subterminal: EST and IST nearly median and about opposite; IT slightly closer to ET than to IST; T somewhat distad of median; ST closer to SB than to T; venom duct of fixed finger with nodus ramosus nearly opposite IT; of movable finger well distad of T (in either case about opposite the eighteenth to twentieth marginal tooth).

Legs of usual facies. Male fore tarsus (fig. 11B) scarcely

modified although somewhat swollen, lacking a terminal spine; claws basally, peculiarly thickened but scarcely asymmetrical, terminally flattened into nearly straight, sharply acuminate, lanceolate, and translucent points (fig. 11D). Fourth tarsus with a submedian, tactile seta (fig. 11J); subterminal seta curved, but untoothed and acuminate (fig. 11J, insert); claws untoothed but peculiarly modified, being basally normal but either terminating bluntly at a point proximad of the usually acute, strongly curved apex, or with the tip of the claw laminiform (as in fore claws) and very delicate in structure, in which case they have been broken from all remaining claws of the only available specimen (fig. 11K).

REMARKS: In spite of some doubtful features noted in the foregoing diagnosis this genus is sharply distinct from any thus far described.

Telechelifer lophonotus, new species

Figure 11

MATERIAL: Holotype, male (JC-565.03001), from India or Ceylon, probably the latter. Coll. E. E. Green. No additional material known.

DIAGNOSIS: (Male only; female not known.) Carapace (fig. 11F) nearly smooth, at most weakly tessellate laterally; with two equally prominent transverse furrows, the anterior of which is laterally procurved, the posterior gently recurved throughout its length. True corneate eyes present, less than their diameter from the anterior carapacal margin. The carapace is unique in that the median disk is strongly constricted posteriorly and produced into a lateroposteriorly projecting crest similar to the lateral crests of the tergites; the posterior disk (as is often the case in other species also) tergiform and laterally crested. Vestitural setae relatively sparse, slender, and denticulo-acuminate.

Tergites nearly or quite smooth but weakly tessellate; vestitural setae slender and denticulo-acuminate (fig. 11C). Tergites 1 to 3 entire, tergite 4 showing a trace of a division, tergites 5 to 10 divided by a linear suture, tergite 11 entire and not fused with sternite 11. In general uniseriate; chaetotaxy (exclusive of the lateral discal setae that occur on segments 1 to 10, inclusive): 14:16:10:16:14:14:12:14:14:10:1T4T1:2m. Tergites 1 to 4 with distinct, tergite 5 with vestigial, lateral crests (fig. 11F).

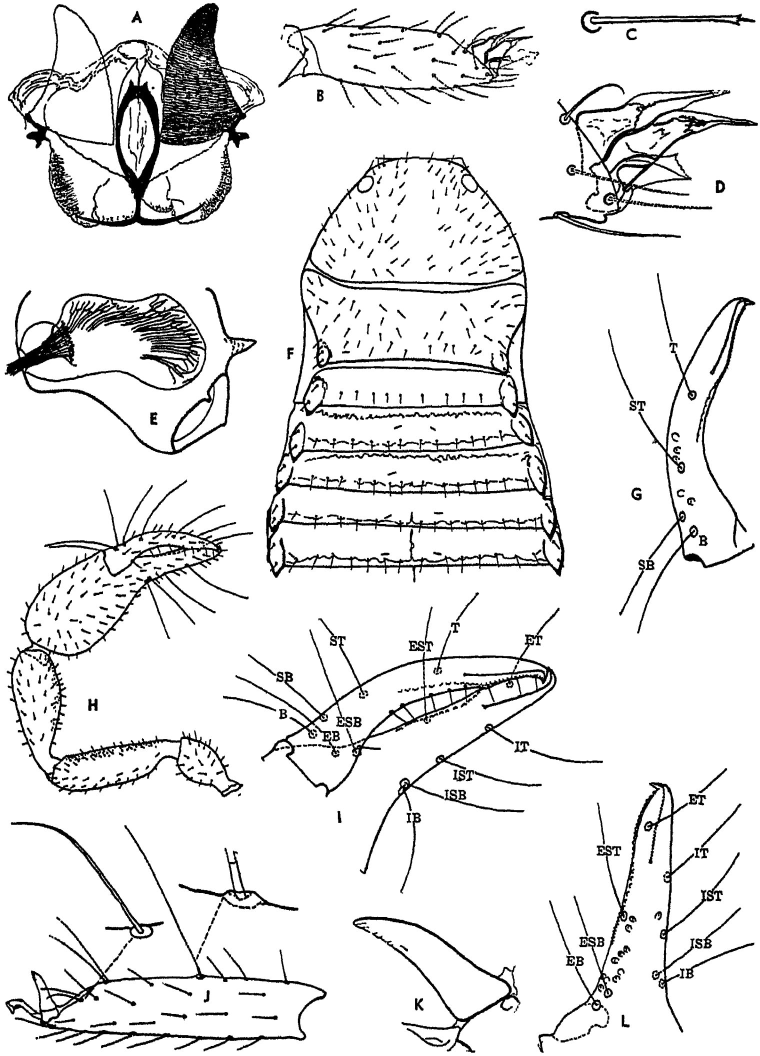

FIG. 11. *Telechelifer lophonotus*, new species (all illustrations from male holotype). A. Sketch of male genital structures; ramshorn organs abnormally displaced anteriorly. B. Anterior aspect of left fore tarsus; setae mostly lost from specimen; reconstructed. C. Vestitural seta; fourth tergite. D. Anterior aspect of left praetarsus of leg I; arolium omitted. E. Left fourth coxa and coxal sac. F. Carapace and tergites 1 to 4. Note lateral crests of median and posterior disk of carapace. G. Exterior aspect of movable finger of left chela. H. Ventral aspect of right palp. I. Interior aspect of fingers of right chela in closed position. J. Anterior aspect of right fourth tarsus; setae mostly lost; reconstructed. Inserts: left, subterminal seta; right, base of tactile seta. K. Right anterior claw of fourth tarsus. L. Subinterior aspect of fixed finger of left chela.

Sternites 4 to 10 divided, sternite 11 entire and similar to tergite 11; setae slender and acuminate. Chaetotaxy of segments 4 to 12 (exclusive of the usual lateral discal setae that occur on segments 4 to 12, inclusive): (1)16(1):20:18:16:16:14:3T4T3: 1T4T1:2m. Tactile setae of terminal segments broken from specimen, but the sizes of the areoles clearly indicate their presence.

Genital structure of typical dactylocheliferine facies; general appearance as sketched (fig. 11A). Fourth coxa (fig. 11E) unusually broad, with prominent lateral spurs. Coxal sacs (fig. 11E) large and inflated, largely filling the cavity of the fourth coxae; atrium not constricted posteriorly but deeply so anteriorly; lateral anterior walls abundantly provided with "setae," about 30 to 35 in all, opening flush with mesal walls of coxae.

Chelicera of normal facies; chaetotaxy normal, no accessory setae; character of *sb* and *b* not ascertainable (lost from only known specimen); galea present but broken in holotype; serrula exterior with 18 or 19 ligulate teeth.

Palps unicolorous, slender, but with chela unusually large compared to the other palpal segments (fig. 11H). Heel and anterior face of trochanter, inner face of femur, and tibia and chela at base of fingers very finely and evenly granulate, elsewhere quite smooth. Palps longer than body; trochanter with rounded heel, 2.00 times as long as broad; femur shorter than tibia and 3.46 times as long as broad; tibia not quite so long as carapace and 2.93 times as long as broad; chela about as broad as deep and about 2.8 (plus pedicel 3.0) times as long as broad; fingers and hand subequal in length, both distinctly shorter than femur. (Proportions of chela somewhat doubtful owing to partial crushing.)

Chela markedly gaping (fig. 11I). Chaetotaxy and dentition as illustrated (fig. 11G, I, L). Dental contour of the fingers straight and normally dentate for the distal third, proximad thereof with a deep and opposing concavity on either finger in which the marginal teeth are reduced and somewhat irregularly spaced; marginal teeth of movable finger total 25, of which the seventeenth marks the beginning of the concavity previously noted, and the twenty-fifth tooth marks the "bottom" of the concavity; dentition of fixed finger similar to that described for the movable finger but totaling 31 or 32 and somewhat better developed within the dental concavity than on the movable finger.

Leg I: "miofemur" longer than palpal trochanter, 3.3 times as long as deep; tibia 3.2 times as long as deep; miotarsus slightly longer than breadth of palpal tibia and 3.5 times as long as deep. Fore tarsus (fig. 11B) lacking an apical spine; claws scarcely asymmetrical but peculiarly thickened and terminating in a translucent, lanceolate, and sharply acute point (fig. 11D).

Leg IV of usual facies, "miofemur" 2.9 times as long as deep, tibia 4.2 times as long as deep, tarsus 4.4 times as long as deep. Fourth tarsus (fig. 11J) with a tactile seta, which is .40 of total, and .56 of dorsal, length from base of segment (broken from holotype but almost certainly as indicated). Tarsal claws untoothed (fig. 11K).

Measurements (mm.): Male holotype: Total length 2.72. Abdominal breadth about 1.0–1.1. Carapace: .92 long; ocular breadth .44; posterior breadth .84; breadth at anterior furrow .82; breadth from crest to crest of median disk .67, of posterior disk .76; anterior disk .48 long; median disk .30 long; posterior disk .15 long; cucullus .057 long; diameter of eyes .085. Length of tergites 1 to 6, inclusive: .16, .15, .12, .15, .16, .20. Palps: trochanter .478 by .239; femur .804 by .231; tibia .836 by .287; chela 1.312 (plus pedicel 1.386) by .467±; hand .722 (plus pedicel .795) long; fingers .722 long. Venom ducts .212 long. Leg I: "miofemur" .505 by .151; tibia .369 by .117; miotarsus .310 by .088. Leg IV: "miofemur" .717 by .246; tibia .590 by .140; miotarsus .426 by .096. Dorsal length of tarsus IV (base to apical setae) .309; tactile seta .173 from base of segment.

Remarks: The measurements of the carapacal breadth are somewhat uncertain owing to partial flattening of the structure under the cover slip of the slide preparation.

The structure of the pedal claws (aside from those of the fore leg) is open to some doubt. Nearly all are broken from the only available specimens, and those that remain appear to have lost their terminal half. It is possible that they are similar to the fore claws, and that the delicate, thinned-out, and transparent apex, such as occurs in the fore claws, also occurs on the others. Their resulting delicacy in that case would readily account for their breakage; otherwise almost entirely inexplicable.

The chelicerae of the holotype were unfortunately lost (after the preparation of this description) in the course of remounting the specimen.

PROTOCHELIFER BEIER

Protochelifer BEIER, 1948, Eos, vol. 24, no. 4, pp. 552–553.

GENEROTYPE (ORTHOTYPE): *Protochelifer nova-zealandiae* Beier.

DISTRIBUTION: New Zealand and Australia.

DIAGNOSIS (REVISED): (Based on males only; female representatives not available.) Cheliferine genus of generally typical facies.

Carapace evenly and densely granular, about as broad posteriorly as long; with true, corneate eyes and two deeply grooved transverse furrows; no trace of lateral crests on the posterior disk; vestitural setae denticuloclavate.

Abdomen ovate; all tergites and sternites including the eleventh more or less clearly longitudinally divided; pleural membrane smooth, more or less evenly longitudinally striate; vestitural setae of tergites distinctly denticuloclavate (fig. 12B); sternal setae acuminate; tactile setae completely lacking on terminal segments. Tergites and sternites uniseriate except for usual lateral discal setae on some of the segments. Tergites with about 20 to 30, sternites with about 25 to 40, marginal setae. Tergal crests lacking in male. Sternites 4 to 9 with large, transversely paired, smooth, and non-tessellate discal areas, which are characterized by a more or less even scattering of microlyrifissures (fig. 12A).

Genital area of male of a modified dactylocheliferine type, statumen convolutum more or less rounded; ramshorn organs absent (figs. 12I, 13F). Fourth coxae larger than usual, lacking lateral spurs, with very large, "inflated" coxal sacs, the atrium of which is very small and nearly vestigial (fig. 12H, I).

Chelicerae of usual facies; chaetotaxy of usual cheliferine type, except that accessory setae may occur between setae *sb* and *es;* all cheliceral setae acuminate; galea a nearly simple stylet in the male; flagellum three bladed; serrula exterior with about 20 ligulate blades.

Palps unusually slender; densely and evenly granulate except for the fingers; vestitural setae thickened, denticulate but not clavate. Chaetotaxy and venom apparatus of chela as illustrated (figs. 12G, 13A, B); setae ET and IST closely associated, nearly terminal; setae IST and EST about opposite, median in position between ET or IST and ESB-EB; nodus ramosus about opposite seta EST; seta ST of movable finger distad of median, much closer to T than to SB and about opposite the nodus ramosus. Sense spots rare or absent.

Legs of usual facies. Unusual in that the fore tarsus of the

male is almost completely typical of the usual pedal tarsi and not at all modified or differentiated as is usual in most Cheliferinae; with tarsal claws of leg I somewhat asymmetrical but not markedly different from those of the other legs (figs. 12C, 13C). Subterminal setae arcuate, untoothed, and acuminate; claws untoothed; fourth tarsus completely lacking a tactile seta (fig. 13L).

REMARKS: The non-modified male fore tarsus and the microlyrifissure-bearing areas of the male sternites are unique in the Cheliferinae. The absence of ramshorn organs, while unusual, is paralleled in *Ellingsenius* and *Haplochelifer*. Although definitely an aberrant type, *Protochelifer* is undoubtedly a member of the cheliferine tribe Dactylocheliferini as presently understood. The definitely delimited areas of microlyrifissures on the male sternites, while more diffuse, strongly suggest the sternal bristle patches of male Withiinae. On the other hand the strongly oblique femoral articulation of legs I and II is typically cheliferine, as is the possession of coxal sacs.

The four included species may be separated by means of the following key:

KEY TO SPECIES OF *Protochelifer* (BASED ON MALE ONLY)

1. Chela about 3.5 times as long as broad, and about 1.6 times as long as the femur; tibia robust, about 3 to 3.5 times as long as broad; fingers and hands of about equal length; from Australia........ *brevidigitatus* (Tubb)
   Chela not less than 4 times as long as broad and 1.3 to 1.45 times as long as the femur; tibia slender, not less than 4 times as long as broad; fingers distinctly longer than hand..2
2. Cheliceral palm with one accessory seta (six in all); from New Zealand ....*novae-zealandiae* Beier
   Cheliceral palm with either none or two accessory setae (either five or seven in all)..3
3. Cheliceral palm with only the usual five setae; chela 4.1 to 4.2 times as long as broad; each scutum of sternite 7 of male with about 30 to 50 microlyrifissures (fig. 12A). Sternite 9 lacking microlyrifissures; from New Zealand..*maori*, new species
   Cheliceral palm with seven setae (two accessory seta); chela 4.7 to 4.9 times as long as broad; microlyrifissures of seventh sternal scuta much more numerous, numbering in excess of 100 (fig. 13J); sternite 9 with numerous microlyrifissures; from Australia...........*australis* (Tubb)

Protochelifer maori, new species

Figure 12

MATERIAL: Holotype, male (JC-95.01001), collected "under the rolls of papery bark of *Fuchsia iscortierata*" in the rain forest at

Porirua, New Zealand, on October 20, 1920, by Dr. Robert E. Grimmet, to whom I am indebted for this specimen.

DIAGNOSIS. (Male only). Carapace evenly and densely granulate; with two distinctly corneate eyes, which are slightly more than their own diameter from the anterior carapacal margin; anterior furrow almost median; posterior furrow half as far from

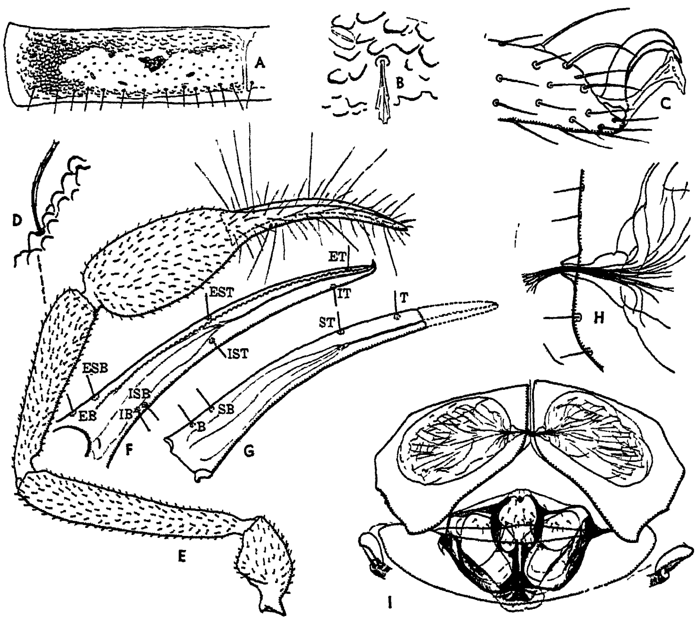

FIG. 12. *Protochelifer maori*, new species (all drawings from male holotype). A. Right half of sternite 7 showing pattern of sculpturation, zone of microlyrifissures, and chaetotaxy. B. Denticuloclavate seta from tergite 6. C. Tip of male fore tarsus showing symmetrical fore claws and acuminate subterminal seta. D. Vestitural seta from tibia. E. Dorsal aspect of left pedipalp. F. Subventral aspect of fixed finger of right chela. G. Ventral aspect of movable finger of chela (reconstructed in part) showing venom apparatus and chaetotaxy. H. Median opening of coxal sac. I. Male genital structures and fourth coxae with coxal sacs. Note reduction of atrium.

the posterior carapacal border as from the anterior furrow; vestitural setae thickened and terminally and subterminally dentate (as in *P. australis*, fig. 13D, inserts).

Tergites 1 to 11 and sternites 4 to 11 divided into scuta by a longitudinal suture. Tergites densely squamosely granulate; vestitural setae distinctly denticuloclavate (fig. 12B); uniseriate

except for usual lateral discal setae which occur on segments 4 to 10; exclusive of these the tergal chaetotaxy is as follows: 20:19:21:19:23:23:21:18:17:17:15:2m. Tergites lacking lateral keels. Coxal area broadest across the unusually expanded fourth coxae; maxillae granulosquamose but nearly smooth on ventral surface; other coxae tessellate at most, nearly smooth. Sternites distinctly tessellate and slightly rugose, except for a smooth, transverse, subovate, central area on each scutum of segments 4 to 9 which completely lacks tessellations (except for a central darker spot) and is rather sparsely sprinkled with microlyrifissures (fig. 12A); smooth discal area of segment 9 distinct, but almost completely lacking the microlyrifissures typical of the preceding segments. Sternites uniseriate; vestitural setae acuminate; chaetotaxy (segments 4 to 12 and exclusive of the usual lateral discal seta which occur on sternites 9 and 10):

$$(1)13(1){:}22{:}24{:}24{:}21{:}19{:}17{:}\frac{6}{13}{:}2\mathrm{m}.$$

General appearance of genital area about as sketched (fig. 12I); ramshorn organs absent; statumen convolutum not incised. Coxal sacs relatively large, inflated; atrium very small (fig. 121, H); fourth coxae lacking anterolateral spurs.

Chelicera of usual facies; anterior blade of flagellum with five or six subterminal, anterior denticulations, the two posterior blades untoothed and acuminate; with only the usual five setae on the palm of the chelicera (accessory setae lacking); serrula exterior with 19 ligulate teeth; galea slender, nearly stylet-like but with vestigial indications of terminal and subterminal branches.

Palps slender (fig. 12E); densely and evenly granular on all surfaces and segments except the distal two-thirds of the fixed finger, the movable finger, and the ventral surface of the hand just proximad of the articulation of the movable finger; vestitural setae numerous, short, somewhat thickened, and denticulo-acuminate. Trochanter with a rounded subdorsal protuberance, 1.86 times as long as broad; femur longer than tibia and 5.74 times as long as broad; tibia longer than fingers, wider than femur and 4.49 times as long as broad; chela slender, 4.15 (plus pedicel 4.35) times as long as broad; fingers 1.27 times as long as hand.

Chela with dentition and chaetotaxy as illustrated (fig. 12F. G); marginal teeth numbering 51 to 52 on either finger.

Legs slender; granulosquamose; vestitural setae thickened, denticulate, and nearly lanceolate dorsally, acuminate ventrally; tactile setae completely lacking on third and fourth tarsi; claws simple, untoothed; subterminal setae arcuate but acuminate. Fore tarsus of male completely typical of the other tarsi including the acuminate, and almost, if not quite, completely symmetrical fore claws (fig. 12C). Leg I: "miofemur" 3.64 times as long as deep; tibia 5.02 times as long as deep; miotarsus 5.90 times as long as deep. Leg IV: "miofemur" 2.96 times as long as deep; tibia 5.58 times as long as deep; miotarsus 5.97 times as long as deep.

MEASUREMENTS (MM.): Total length 2.98. Abdominal breadth 1.45. Carapace: 1.02 long; ocular breadth .48; posterior breadth 1.09; cucullus .102 long; ocular diameter .090; ocular disk .49 long; median disk .36 long; posterior disk .17 long. Length of tergites 1 to 6, inclusive: .19, .17, .14, .17, .20, .20. Palps: trochanter .566 by .306; femur 1.253 by .218; tibia 1.121 by .249; chela 1.796 (with pedicel, 1.891) by .433; hand .827 long; fingers 1.034 long. Leg I: "miofemur" .651 by .179; tibia .493 by .096; miotarsus .440 by .074. Leg IV: "miofemur" .915 by .309; tibia .725 by .130; miotarsus .525 by .088.

Protochelifer australis (Tubb)

Figure 13

Ideochelifer (*pro Idiochelifer*) *australis* TUBB, 1937, Proc. Roy. Soc. Victoria, new ser., vol. 49, no. 2, p. 414, figs. 3a (female palp), 3b (male palp), 3c, 3d (vestitural setae).

MATERIAL: Male paratype (JC-1603.01001) received through the courtesy of J. A. Tubb. Australia, Lady Julia Percy Island (near Seal Bay). Rock-dwelling species. January, 1936. Coll. J. A. Tubb. Types in National Museum at Melbourne.

DIAGNOSIS (ADDENDA): Carapace evenly and densely granulate; form as illustrated (fig. 13D); vestitural setae thickened, denticulate (fig. 13D, inserts). All tergites, including the eleventh, divided by linear suture; all densely squamosely granulate or tessellate; vestitural seta short, denticuloclavate (fig. 13I), except on tergite 11 where they are thickened and denticuloacuminate. All tergites uniseriate, except segments 4 to 10 which possess the usual pair of lateral discal setae; exclusive of these the chaetotaxy is as follows: 19:22:24:23:24:27:26:25:21:22:14:2m. Tergites lack lateral keels. Coxal area narrowest

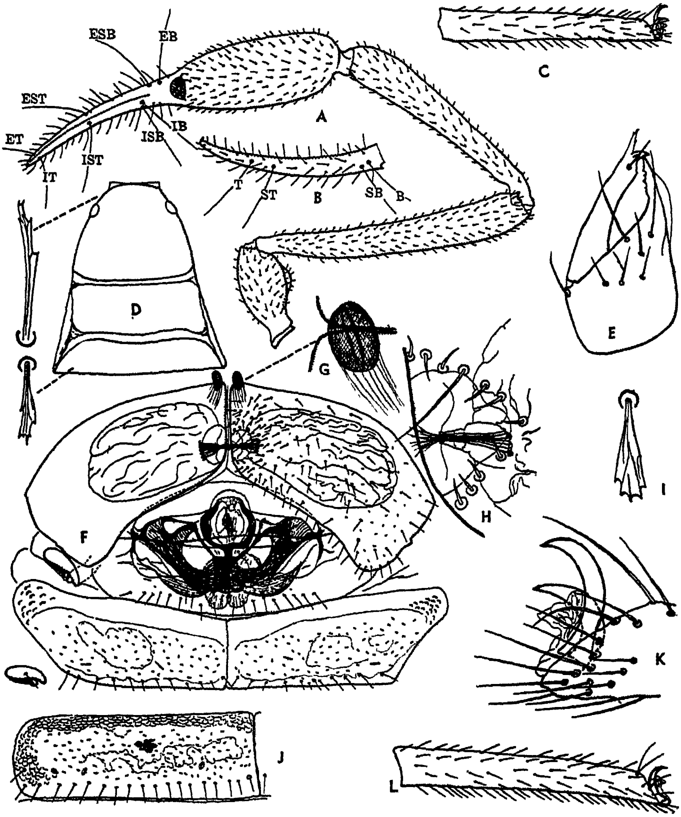

FIG. 13. *Protochelifer australis* (Tubb) (all drawings from male paratype). A. Ventral aspect of left pedipalp. B. Exterior aspect of movable finger of left palp. C. Posterior aspect of right fore tarsus. D. Carapace; setae omitted. Inserts: character of vestitural setae. E. Exterior aspect of left chelicera; serrulae omitted. F. Male genital area including the fourth coxae, genital sacs, and sternite 4. Note zone of discal microlyrifissures on sternite 4. G. Condylar-like structure at inner apex of fourth coxa; significance unknown. H. Detail of opening pore of coxal sac and bordering setae. I. Tergal seta. J. Right scutum of sternite 7 showing dermal sculpturation, chaetotaxy, and discal zone of microlyrifissures. K. Anterior aspect of right fore claws. L. Anterior aspect of left fourth tarsus.

across first coxae and broadest across the fourth; maxillae granulosquamose, nearly smooth on ventral surface; other coxae tessellate but nearly smooth. Sternites 4 to 11 more or less completely divided by a linear suture; nearly smooth but dis-

tinctly squamosely tessellate, except for the discal areas of sternites 4 to 9 which are large, completely smooth, and thickly sprinkled with abundant microlyrifissures (fig. 13J); microlyrifissures about half as numerous on sternite 9 as on the preceding segments; vestitural setae acuminate; sternal chaetotaxy (segments 4 to 12 omitting the usual lateral discal setae of sternites 6 to 10, inclusive): (1)21(1):30:37:35:35:31:27:15: 2 m.

General appearance of genital area as sketched (fig. 13F); coxal sacs as illustrated (fig. 13F, H); fourth coxae lacking lateral spurs.

Chelicerae small, of usual cheliferine appearance; palm of chelicera with seven acuminate setae (two accessory setae occur between setae *b* and *es*, fig. 13E); galea short with a few minute, lateral, and terminal branches; serrula exterior with 21 ligulate teeth; flagellum three bladed, anterior blade broad and anteriorly with four or five subterminal denticles, others simple and acuminate.

Palps (fig. 13A) of very slender facies; all segments, except fingers and the ventral surface of the chela, distinctly and evenly granulate; vestitural setae relatively short, somewhat thickened, and clearly denticulo-acuminate (not lanceolately acuminate as illustrated by Tubb). Trochanter with a weak, rounded, subdorsal protuberance, 2.02 times as long as broad; femur scarcely pedicellate, evenly expanded from base to tip, 6.94 times as long as broad; tibia weakly pedicellate, slightly shorter than femur and 5.97 times as long as broad; chela distinctly pedicellate, subequally expanded exteriorly and interiorly, 4.92 (with pedicel 5.14) times as long as broad; fingers much shorter than tibia and 1.14 times as long as hand.

Chela with dentition and chaetotaxy as illustrated (fig. 13A, B); fixed finger with 55, movable with 58, marginal teeth; venom ducts not observable in the only available specimen, but no doubt much as in *P. maori*, new species (see fig. 12F, G).

Legs very slender; claws simple and untoothed; subterminal setae acuminate; tactile setae completely lacking from third and fourth tarsi (fig. 13L); fore tarsus of male not significantly differentiated from the others (fig. 13C) but fore claws are apparently slightly asymmetrical (fig. 13K); dorsal vestitural setae of legs thickened, denticulate; ventral setae acuminate. Leg I: "miofemur" 4.96 times as long as deep; tibia 6.65 times as long as deep; miotarsus 7.79 times as long as deep. Leg IV: "mio-

femur" 3.84 times as long as deep; tibia 7.63 times as long as deep; miotarsus 7.40 times as long as deep.

MEASUREMENTS (MM.): Male paratype: Total length 3.48; abdominal breadth about 1.5–1.6. Carapace: 1.16 long; ocular breadth .54; posterior breadth 1.08 (about); anterior disk .61 long; median disk .34 long; posterior disk .21 long; cucullus .123 long; ocular diameter .098. Lengths of tergites 1 to 6: .21, .15, .16, .18, .20, .21. Palps: trochanter .640 by .317; femur 1.624 by .234; tibia 1.451 by .243; chela 2.050 (with pedicel, 2.142) by .417; hand .968 long; fingers 1.099 long. Leg I: "miofemur" .823 by .166; tibia .672 by .101; miotarsus .623 by .080. Leg IV: "miofemur" 1.132 by .295; tibia .984 by .129; miotarsus .733 by .099.

REMARKS: These measurements are derived entirely from the single male paratype studied by me, and hence no indication can be given as to the amount of variation to be expected. This is likely to be considerable in the case of attenuated appendages such as characterize this species. The proportion of the tibia, as given by Tubb, markedly differs from the one here given (4.8, compared to 5.97 times as long as broad). This may perhaps be within the normal range of variation, although I rather strongly suspect that remeasurement of the holotype and allotype will show that the tibial proportions are actually more slender than indicated by Tubb. His illustration of the palps agrees well with the paratype before me. Tubb gives no measurements aside from the total length (3.8 mm.).

Protochelifer brevidigitatus (Tubb)

Ideochelifer (*pro Idiochelifer*) *brevidigitatus* TUBB, 1937, Proc. Roy. Soc. Victoria, new ser, vol. 49, no. 2, p. 414, figs. 2a (male palp), 2b (palpal seta), 2c (tergal seta).

REMARKS: This species is not known to me. Judging from Tubb's brief account, however, it would appear probable that the generic assignment here made is correct.

The unique type was taken under a basalt boulder on Lady Julia Percy Island, Australia. Type in the National Museum at Melbourne.

GENUS **ELLINGSENIUS** J. C. CHAMBERLIN

Ellingsenius J. C. CHAMBERLIN, 1932, Canadian Ent., vol. 64, p. 35.
Ellingsenius Chamberlin, BEIER, 1932, Das Tierreich, vol. 58, p. 274.

GENEROTYPE (ORTHOTYPE): *Chelifer sculpturatus* Lewis.

DIAGNOSIS (REVISED): Carapace of usual shape, generally deeply sculptured or tuberculate; true eyes lacking, but eye spots present; with two well-developed transverse furrows; vestitural setae short and robust, terminally more or less denticulate or, sometimes, semiclavate.

Abdomen ovate, broadest subterminally; tergites often markedly tuberculate or deeply sculptured and usually more or less granulate, in part at least; biseriate; vestitural setae short, thickened, and terminally denticulate or sometimes semiclavate. Tergal crests well developed, in the male at least, while in some species reduced tergal crests occur in the female as well. Tactile setae not developed, dorsally or ventrally on posterior abdominal segments. Sternites 4 to 11 divided by linear suture; biseriate; with a poorly defined discal zone of microlyrifissures anterior to the discal series of setae; sternal setae acuminate, except on the posterior segments where they are thickened and terminally denticulate.

Genital area of typical dactylocheliferine facies. Median cribriform plate of female fused into a single median structure; statumen convolutum of male rounded anteriorly, not incised; ramshorn organs generally present and well developed but absent (or vestigial?) in some cases. Fourth coxae of male more or less expanded; coxal sacs generally present (when present, with a well-defined atrium), but completely absent in some cases. Tracheal trunks internally minutely papillate.

Chelicerae small; palm with the normal five setae, of which *sb* and *b* are terminally flattened and minutely denticulate; *ls*, *is*, and *sb* closely associated and forming a small equilateral triangle situated subbasally on the fixed finger (rather than on the palm of the chelicera itself, fig. 14E); *b* associated with *es*, being about as far removed therefrom as *sb* is from *ls* and *es;* movable finger with three distinct galeal setae in sharp contradistinction to the single one that characterizes nearly all other false scorpions; subterminal lobe large and crenate (fig. 14I); flagellum of three blades; spinneret a slender-branched galea, which may be somewhat better developed in the female than in the male (not distinctly, sexually dimorphic; fig. 14D, I).

Palps granulate and most often provided with very large and prominent setiferous tubercles, which are sometimes so abundant as to obscure the normal contour of the femur and the tibia in

particular; vestitural setae short, thickened, terminally denticulate, sometimes semiclavate. Dentition and chaetotaxy of the chela of the essential pattern shown in figure 14C.

Legs of usual cheliferine facies; tarsal claws untoothed, acuminate; fourth tarsus completely lacking a tactile or pseudotactile seta; subterminal setae of all tarsi dorsally monodentate; male fore tarsi generally more or less clearly differentiated from the usual form, but not provided with a tarsal spine except in species where all tarsi, one to four, are provided (in both sexes) with a terminal tarsal spine (e.g., in *Ellingsenius indicus*).

REMARKS: Contrary to Beier's diagnosis (*loc. cit.*) the subterminal tarsal seta in this genus is bifid or uncinate, not simple. This same error was made still earlier by Chamberlin (1932, Canadian Ent., vol. 64, p. 18).

Five species of *Ellingsenius* currently referred to the genus may be separated by means of the following key:

1. Even contour of palps broken, at least medially on the femur and tibia, by the presence of extremely large and setose, wart-like protuberances....2
   Contour of palps normal, completely lacking any significant trace of large, wart-like tubercles even on the inner face of femur or tibia..............4
2. Medial face of tibia and femur with relatively sparse scattering of wart-like tubercles; exterior face of both these segments normal and smoothly granulate.......................................*ugandanus* Beier
   Medial and dorsal aspects, as well as posterior face of femur at least, thickly beset by very large, wart-like tubercles, which are sufficiently abundant to obscure the normal contour of the segment.........................3
3. Prominent tarsal spines present on all legs in both sexes; posterior face of tibia smoothly granulate; coxal and genital sacs of male reduced or absent......................................*indicus* Chamberlin
   Tarsal spines absent from all legs (including the male fore leg); posterior face of tibia with wart-like tubercles as abundant as on its inner face; coxal sacs and ramshorn organs of male present and well developed........
   ....*sculpturatus* (Lewis)
4. Palps robust; femur of female 2.8 times, tibia 2.3 times, and chela 3.1 times, as long as broad; subterminal seta of tarsus typically bifid or unicate......
   ....*fulleri* Hewitt and Godfrey
   Palps more slender; femur 3.0, tibia 2.6, and chela 2.7, times as long as broad; subterminal setae of tarsus simple (?) (*teste* Beier)................
   ....*somalicus* Beier

With the exception of *Ellingsenius somalicus* Beier, which was described from a single female from Afmadu Oltregiula, Italian Somaliland, all these species are now known to occur as commensals of honeybees. *E. fulleri* was recorded from beehives from Douglas, Willowmore, and Bergvliet (near Cape Town) in the

Union of South Africa. *E. sculpturatus* is known to be widely distributed in beehives throughout the following South African provinces: Cape Province, Natal, Transvaal, and Southern Rhodesia. In addition, there is an ostensible record from southern California (Chamberlin, 1932) which, if valid (i.e., if the collection data are correct), probably indicates its introduction into the United States with bees.

Ellingsenius indicus was not known to be associated with bees at the time of its original description, but a recent collection reported hereinafter definitely indicates habits closely similar to those of its better-known relative, *E. sculpturatus*.

Ellingsenius indicus J. C. Chamberlin

Figure 14

Chelifer sp. J. C. CHAMBERLIN, 1931, Stanford Univ. Publ., Biol. Sci., vol. 7, no. 1, p. 81, figs. 18, T (male galea), 39, G (male chela), p. 160, fig. 42, P (tarsus, leg IV of male) and Q (praetarsus, leg I of male), p. 187, fig. 51, M (sketch of male genitalia).

Ellingsenius indicus J. C. CHAMBERLIN, 1932, Canadian Ent., vol. 64, pp. 36–37 (Ootacamund, India). BEIER, 1932, Das Tierreich, vol. 58, pp. 276–277; 1937, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 633–634, t.f. 1, 2 (male and female pedipalp and fore tarsus of male).

MATERIAL: Two males, three females, two tritonymphs, and one deutonymph (JC-841.01001–841.01008) from "inside beehives at Coonoor, Nilgiris, India.... Coll. M. C. C. March 17, 1936." Submitted for determination by F. H. Gravely of the Madras Museum. Male and female specimens JC-841.01001 and 841.01002 and immature specimens JC-841.01006–841.01008 are in author's collection; balance of material is in the Madras Museum. The holotype is also deposited in the Madras Museum.

DIAGNOSIS (EMENDED): (Applies to adults of both sexes unless otherwise indicated.) Carapace as broad as, or slightly broader than, long; ocular disk longer than median and posterior disk combined; posterior disk tergiform, in the male with lateral crests; moderately setose, each seta occurring on a large, wart-like tubercle except on the anterior median part of ocular disk and on the posterior disk; chaetotaxy approximately: 16 to 18–22 to 24 (300±). Carapace evenly granulate laterally (between tubercles) and weakly granulate on the posterior part of the ocular and the median disks. Maxillaris apicalis with a long lateral and short median seta; apex of median disk of maxilla with a moder-

ately long semi-tactile seta; maxillae smooth, except for postclivus and maxillaris apicalis which are evenly granulate.

Abdomen short, broad, and ovate; pleural membrane hispidously wrinkled; tergites strongly sclerotic, weakly squamo-

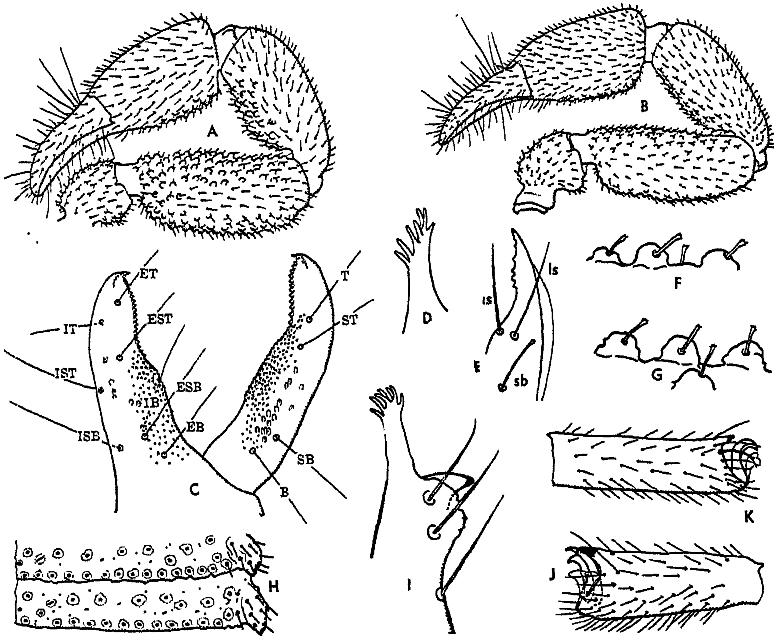

FIG. 14. *Ellingsenius indicus* Chamberlin (structures of male drawn from specimen JC-841.01001; of female, from specimen 841.01002). A. Ventral aspect of left palp of male. B. Ventral aspect of left palp of female. C. Exterior aspect of right chela of female. D. Male galea. E. Fixed finger of chelicera of female. F. Setiferous tubercles from inner margin of female palpal femur (same scale as fig. G). G. Setiferous tubercles of inner margin of male palpal femur (same scale as fig. F). H. Right half of tergites 4 and 5 of male showing lateral crests, the areolate setal insertions (setae mostly omitted), microlyrifissures, and "sense spots." I. Tip of movable finger of female chelicera showing galea and triplicated galeal setae. J. Fore tarsus of male. K. Fore tarsus of female.

tessellate but not granular; all tergites and sternites, including 11, longitudinally divided by a linear "suture"; setose tergal spurs (lateral crests) developed on segments 1–10 (reduced on 10) in male (fig. 14H) absent in female; tergites with 16 to 22 discal and 24 to 26 thickened and terminally minutely denticulate, mar-

ginal setae, each of which is inserted in a large clear areole except on the tergal spurs (fig. 14H); sternal chaetotaxy essentially similar but setae are acute; anus subventral, concealed by evenly rounded eleventh tergal scuta and fitting into a slight emargination of the eleventh sternal scuta; anal opercula dorsally and ventrally bisetose; a short, median, discal, pseudo-tactile seta occurs on either scutum of sternite 11.

Coxal sacs and ramshorn organs absent in the male; genital area of male otherwise typical of tribe (see Chamberlin, 1931, fig. 51, M).

Chelicerae typical of the genus; galea not sexually differentiated, terminally seven branched (fig. 14D, I); chaetotaxy as illustrated (fig. 14E); serrula exterior with 24 to 26 teeth.

Palps moderately robust, as illustrated (fig. 14A, B); the large, wart-like tubercles larger and better developed in the male than in the female, occurring subdorsally on the hand and dorsally on the tibia, femur, and trochanter, as well as anteriorly on the hand and tibia, and both posteriorly and anteriorly as well as subventrally on the femur and trochanter (compare fig. 14F and G).

Chela in both sexes showing a median depression in the dental contour of both fingers (fig. 14C); both fingers, exteriorly and adjacent to the proximal teeth, with extensive and distinct granular patches (fig. 14C); chaetotaxy as illustrated; marginal teeth conical and acute in, and distal of, the median depression, but low and scarcely more distinct than the accompanying granulations, caudad thereof, numbering 31 to 33 on the fixed, and 31 to 38 (mostly 31 to 34) on the movable, finger; sense spot distribution as illustrated, with 11 to 14 spots exteriorly on the movable finger and two to three interiorly; three to four sense spots occur both exteriorly and interiorly on the fixed finger; venom apparatus present, but apparently the duct is unusually slender (possibly reduced, position of nodus ramosus not ascertained).

Legs of typical cheliferine type, claws simple and acute, subterminal seta monodenticulate; all tarsi in either sex with a well-developed terminal spine (fig. 14J, K); fore tarsus of male moderately differentiated sexually, expanded from base to tip and with claws moderately asymmetrical but untoothed (fig. 14J); tarsus IV completely lacking a tactile seta.

Appendicular Proportions: (Not including the large tuberculations of the palpal segments; both sexes unless otherwise

indicated.) Body 1.6 to 1.9 times as long as the abdominal breadth. Ocular disk .58 to .63 of the total carapacal length. Palps: trochanter 1.5 to 1.6 times as long as broad; femur 1.6 to 1.8 times as long as trochanter and 2.4 (male) to 2.6 to 2.7 (female) times as long as broad; tibia slightly but distinctly shorter than femur and 2.34 to 2.24 (male) to 2.56 to 2.61 (female) times as long as broad; chela 1.39 to 1.45 times as long as tibia and 2.8 to 2.9 (male) to 3.0 to 3.1 (female) times as long as broad; hand generally very slightly broader than deep, 1.18 to 1.39 times as long as fingers (generally 1.2 times). Leg I: "miofemur" 1.28 to 1.36 times as long as tibia and 2.80 to 2.92 times as long as deep; tibia 1.06 to 1.19 times as long as miotarsus and 2.94 to 3.08 times as long as deep; tarsus 2.74 to 3.08 times as long as deep. Leg IV: "miofemur" 1.36 to 1.47 times as long as tibia and 2.77 to 2.93 times as long as deep; tibia 1.23 to 1.27 times as long as miotarsus and 3.62 to 3.68 times as long as deep; tarsus 3.80 to 4.04 times as long as deep.

MEASUREMENTS: Measurements of specimens of *Ellingsenius indicus* (not treated with potassium hydroxide) are given in table 1. The body breadth refers to the abdomen. Measurements of the palpal segments do not include the large tuberculations.

TRITONYMPH: Facies and structure essentially as in adult with following exceptions: Tergal spurs absent. Galeal setae two only; serrula exterior with 21 teeth. Tuberculation of carapace and palps reduced but still essentially as in adult. Chela as in adult but dental depressions are not so distinct; sense spots distributed as in adult but reduced in number, exteriorly numbering only one on the fixed, and four on the movable, finger, respectively; interiorly with three to four spots on the movable, and five on the fixed, finger, respectively; chaetotaxy as in adult, except that setae IST and SB are absent. Terminal spine of tarsi reduced but still evident on all legs. The appendicular proportions fall within the range given for the adult female, except as follows: tibia 2.46 times as long as broad (within limits given for male); tibia of leg I 2.76 times as long as deep and only 1.03 times as long as tarsus, which is 3.55 times as long as deep; Leg IV: femur 2.81 times as long as deep and 1.49 times as long as tibia; tibia 3.32 times as long as deep; tarsus 3.68 times as long as deep. Measurements as given in table 1.

DEUTONYMPH: Facies very much as in adult. No larger tubercles occur on carapace. Tergal spurs absent. Only one

TABLE 1

MEASUREMENTS (LENGTH BY BREADTH IN MILLIMETERS) OF SEVERAL SPECIMENS OF *Ellingsenius indicus*

	Males		Females		Tritonymph	Deutonymph
Morphological Part	No. 841.01001	No. 841.01004	No. 841.01003	No. 841.01002	No. 841.01007	No. 841.01008
Entire body	3.26 × 2.02	3.38 × 2.06	3.61 × 2.13	3.69 × 2.31	3.61 × 1.92	2.05 × 1.31
Carapace	1.26 × 1.23	1.28 × 1.38	1.28 × 1.47	1 38 × 1.39	1 00 × 1.07	.72 × .74
Palps						
Trochanter	indet. × .443	.735 × .459	.660 × .410	.672 × .450	.508 × .344	.377 × .230
Femur	1.295 × .535	1.352 × .557	1.150 × .426	1.230 × .475	.935 × .362	.606 × .244
Tibia	1.238 × .508	1.282 × .550	1 105 × .424	1.180 × .460	.884 × .358	.582 × .258
Chela	1.750 × .598	1.780 × .627	1.534 × .500	1.711 × .574	1.332 × .458	.950 × .334
Hand, fingers[a]	.984, .808	.994, .811	.918, .661	.962, .808	.745, .642	.508, .492
Leg I						
Miofemur	.755 × .260	.804 × .278	.740 × .258	.814 × .278	.607 × .213	indet.
Tibia	.587 × 200	.606 × .202	.542 × .180	.598 × .193	.442 × .161	indet.
Tarsus	.495 × .180	.525 × .171	.518 × .138	.515 × .136	.420 × .121	indet.
Leg IV						
Miofemur	1.165 × .408	1.122 × .405	1.095 × .374	1.218 × .423	.919 × .326	.620 × .249
Tibia	.825 × .224	.826 × .228	.755 × .205	.827 × .228	.615 × .185	.424 × .148
Tarsus	.647 × .162	.668 × .166	.604 × .159	.672 × .172	.513 × .139	.366 × .115

[a] Length in each case.

galeal seta present; chaetotaxy and facies of chelicera otherwise as in adult; galea only three branched; serrula exterior with 16 teeth. A few (two or three) wart-like tubercles occur on the palpal femur but are otherwise absent or rudimentary. Marginal teeth of chela 24 to 26 on either finger, which scarcely show more than a rudimentary trace of the dental depressions characteristic of the adult; sense spots absent; chaetotaxy of same pattern as in the adult, but setae SB and T (or ST?), IST and ESB are absent. Tarsi of all legs without a trace of the terminal spine; subterminal setae toothed as in adult. Appendicular proportions generally more robust than in the adult female, as follows: Palps: trochanter 1.64 times as long as broad; femur 1.61 times as long as trochanter and 2.48 times as long as broad; tibia shorter than femur and 2.26 times as long as broad; chela 1.63 times as long as tibia and 2.84 times as long as broad; hand scarcely longer than fingers (1.03 times). Leg I: not ascertainable from available material. Leg IV: femur 1.46 times as long as tibia and 2.48 times as long as deep; tibia 1.16 times as long as tarsus and 2.87 times as long as deep; tarsus 3.19 times as long as deep. Measurements as given in table 1.

REMARKS: It may be conjectured that the gaping fingers of either sex in this species are an adaptation to permit their clinging to their "hosts" (bees) at the time of swarming. This habit has been well established for *Ellingsenius sculpturatus*.

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SPONGES OF THE WESTERN BAHAMAS

BY M. W. DE LAUBENFELS[1]

The excellent location and equipment of the Lerner Marine Laboratory at Bimini, in the western portion of the Bahamas (British West Indies), offer exceptional opportunities for the study of fish and other marine life, including sponges. There are certainly more than 30 species of Porifera in this vicinity, although only 29 are here discussed. In June and July, 1948, I devoted a few weeks to field work in and near Bimini; doubtless all the commonest species were thus studied, but rarer forms would certainly be added by any long-continued campaign of collecting. In fact, several small, unidentifiable specimens which were observed in 1948 clearly belonged to other than the 29 that were identified. The commonest species, however, are those that are most likely to play significant parts in the over-all program of the Lerner laboratory, for example, in ecological interrelationship and in physiological experimentation. A principal function of this paper is to render assistance to investigators who are not specialists in the Porifera but who encounter sponges in connection with their research at Bimini. Thus a key to the 14 commonest local sponges is appended.

KEY TO COMMON BIMINI SPONGES

Red	Soft, almost smooth	Fire sponge	*Tedania ignis*
Red	Red orange, tough, and extremely rough	Coral sponge	*Higginsia coralloides*
Orange	Concealed in burrows in $CaCO_3$	Boring sponge	*Cliona vastifica*

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Yellow	Long soft cylinders, somewhat conulose; turns black upon dying	Candle sponge	*Verongia fistularis*
Green	Soft, sometimes branching	Green sponge	*Haliclona viridis*
Blue	Soft, conulose	Heavenly sponge	*Dysidea etheria*
Violet	Hollow tubes, somewhat drab	Tube sponge	*Callyspongia vaginalis*
Drab	Smooth, slippery, shiny	Chicken-liver sponge	*Chondrilla nucula*
Brown	Not conulose; little odor; many shades and shapes	Dingy sponge	*Anthosigmella varians*
Brown	Conulose, conules about 3 mm. apart; little odor; bleeds red after death	Bleeding sponge	*Oligoceras hemorrhages*
Brown	Conulose, conules about 4 mm. apart; strong, disagreeable odor	Stinker sponge	*Ircinia fasciculata*
Blackish	Not conulose, large oscules on top; often large size over all	Manjack sponge	*Spheciospongia vesparia*
Blackish	Conulose; conules about 8 mm. apart; strong, disagreeable odor	Loggerhead sponge	*Ircinia strobilina*
Blackish	Conulose; conules about 3 mm. apart; moderately bad odor	Reef sponge	*Spongia officinalis*

East of the Lerner Marine Laboratory lies a semi-enclosed lagoon, nearly 2 kilometers in diameter, much of which is only about 1 meter deep. Turtle grass is abundant over the bottom, and large gastropods ("conchs") are amazingly common. In fact, a wealth of animal life inhabits the area, and a large fraction of all the animals are sponges. All the 14 keyed kinds except *Higginsia* are abundant, the *Spheciospongia* and *Ircinia* species being especially large, and the *Tedania* specimens very conspicuous. In addition to the 14 here occur (much rarer) *Haliclona rubens*, *Haliclona molitba*, *Siphonochalina siphona*, *Xytopsene sigmatum*, and *Axociella spinosa*. I studied this area extensively by wading, collecting by hand.

Much farther east, some 20 kilometers from the Lerner laboratory, the water is in general deeper, but the McAdam Shoal is interesting. Here, in water some 4 meters deep, the commercial

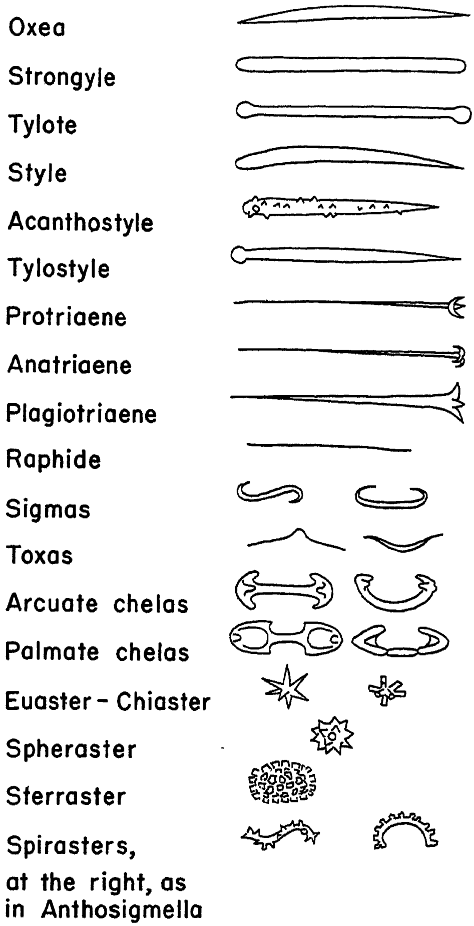

FIG. 1. Spicule types as mentioned in this article.

sponges (*Spongia*) are commonest, *Ircinia* and *Callyspongia* abound, the tubular ones 1 meter high. Here the specimens of *Spheciospongia* are really enormous, up to at least 1.2 meters in diameter, and 1 meter high. This was the only location in which the distinctive and beautiful new species *Ianthella ianthella* was found. I studied this area with the help of a sponge hook, and by dredging.

Except at the east, the Bimini Lagoon is almost enclosed by a series of islands. The southernmost, called South Bimini, is the

largest. South of it, in water about 3 meters deep, sponges are abundant. All the 14 kinds occur, although some are less common than they are inside the lagoon. This locality (off Lovel Creek) was the only one where I found *Higginsia*, and *Cryptotethya*, rare elsewhere, was comparatively common. I studied this area by using the diving helmet, and by dredging.

West of Bimini the Gulf Stream flows, in water that gradually becomes hundreds of meters deep as one goes towards Florida. Here *Spheciospongia* and *Anthosigmella* abound, and both kinds of *Callyspongia* are fairly common. There are poor specimens of *Spongia*, and rarely a *Cryptotethya*. Here I found the only Bimini specimens of *Spirastrella*, *Cinachyra*, and *Geodia*. This area was studied, because of its depth, only by dredging, and (indirectly) by walking along shore, collecting macerated specimens cast up in the wrack on shore by the waves. This latter type of study yielded the only 1948 Bimini specimens of *Agelas* and *Cribrochalina;* these are Porifera that certainly occur to the west of the Lerner laboratory.

The sponges of this portion of the Bahamas may be described as follows:

Spongia officinalis subspecies **obliqua**

REEF SPONGE

A.M.N.H. No. 475

This species may also be known as *Spongia obliqua* and was first named (thus) by Duchassaing and Michelotti (1864, p. 38). It is rounded, often of head size, with black exterior but drab or brown interior, and is very spongy. The surface is finely conulose, with conspicuous oscules but minute pores. The ectosome is a tough skin, the interior densely fleshy. The skeleton is a fine network of elastic fibers. Reef sponges are among the less desirable of commercial sponges, but those that were found on McAdam Shoal were exceptionally good quality as reef sponges go.

In late 1939 a contagious disease of sponges swept through the Bahamas, coming from completely unknown sources, perhaps by mutation of some microbe. In early 1940 it spread throughout all the rest of the West Indies and Florida regions. In the Bahamas the survivors have been protected, and therefore have multiplied so that sponges are again becoming fairly common. In Florida the few surviving sponges were sought even more eagerly than before, by the whole sponge-fishing fleet. As a result, commercial

sponges are all but wiped out in the Florida grounds, and in the late summer of 1948, sponge fishing was in complete abeyance.

No scientific record was made as to the relationship of non-commercial sponges to the epidemic. A casual comment was made that non-commercial sponges were unaffected, but it is very likely that the whole background for this remark was that *Spheciospongia* and *Ircinia* species were unaffected. Sponge fishermen tend to ignore virtually all non-commercial sponges except these; specimens of *Spheciospongia* are noticed because of their immense size and abundance, and of *Ircinia* because they look so much like commercial sponges that even a professional must take pains to discriminate between them, especially if the visibility is at all poor.

In July, 1948, I made a reconnaissance of the shallow waters about the Dry Tortugas, Florida. From 1927 to 1936 I found many species of Porifera extremely abundant there. In 1948 the number and size of individuals were as large as ever, but the species were drastically fewer. A few kinds, such as *Spheciospongia*, *Ircinia*, and *Tedania*, had taken over the area. While other factors in the twelve-year gap may have been to blame for the missing species, one does well to suspect the epidemic that killed so many commercial sponges.

Ircinia fasciculata

STINKER SPONGE

A.M.N.H. No. 476

This world-wide, abundant species was first described as *Spongia fasciculata* by Pallas (1766, p. 381). It was transferred to *Hircinia* by Schmidt (1862, p. 34), but *Hircinia* Nardo (1834, p. 714) is a complete synonym of *Ircinia* Nardo (1833, p. 519) and must be discontinued. Article 32 of the International Rules of Zoological Nomenclature says plainly that a generic name, once published, cannot be rejected, even by its author, because of inappropriateness. It has often been customary to call species of *fasciculata* by the later name *variabilis*. It seems clear that the name *variabilis* was applied by Schmidt (1862, p. 34) to sponges of at least two species. Some of them, blue in color, may retain the name *variabilis*. The others, more or less brown, are clearly *fasciculata*. The species is variable in shape, often reaches head size, is brown and very spongy when wet, but stiff and hard when

dry. The surface is finely conulose, with conspicuous dark oscules and small pores. The ectosome is a tough skin, the endosome a dense flesh. The primary skeleton is coarse, with ascending fascicular fibers full of debris, and a few small connectives. There is also the peculiar *Ircinia* skeleton of myriad scattered microscopic filaments.

Ircinia strobilina

A.M.N.H. No. 477

This is called the loggerhead sponge in the Bahamas, but in the Florida region *Spheciospongia* is so denominated. Both are abundant in the West Indian region.

This species was first named *Spongia strobilina* by Lamarck (1816, p. 383) and was transferred to *Hircinia* by Topsent (1933, p. 15). It is here put into *Ircinia* for the same reasons given above for *fasciculata*. It is usually cake shaped, often larger than a pumpkin, black exterior over brown interior (gray if grown in the shade) and is very spongy when wet, but hard and stiff when dry. The surface is very coarsely conulose, with moderately large oscules and pores. The ectosome is a tough dermis, and the interior is fleshy. The skeleton is much like that of *fasciculata* but coarser.

Oligoceras hemorrhages

Bleeding Sponge

A.M.N.H. No. 478

This common West Indian sponge was first described by de Laubenfels (1936, p. 16). After it is dead, but not before, it gives off fairly large quantities of a cerise or blood-red exudate. This is not evident in pickled specimens, and is inconspicuous unless the sponge is at least lightly squeezed. This species is of varying massive shapes, often fist size, dull brown, and is softly spongy. The surface is finely conulose, with small oscules and pores. The ectosome is a thin skin, and the endosome is fleshy. The skeleton is a rather large-mesh reticulation of weak fibers that often contain foreign material.

Verongia fistularis

Candle Sponge

A.M.N.H. No. 479

This was first described as *Spongia fistularis* by Pallas (1766, p. 385) and transferred to *Verongia* by Bowerbank (1845, p. 403).

Later authors have put this in the genus *Aplysina*. As originally established by Nardo (1834, p. 714), it had no species, but Schmidt in 1862 (p. 25) used the name *Aplysina aerophoba* for a sponge much like *fistularis*. Many experts have thought that Schmidt should be followed because of Opinion 46 of the International Committee on Zoological Nomenclature that the first species published in connection with the genus becomes *ipso facto* the type, but this opinion also states that the genus contains all the species that come under the generic description as originally published. Schmidt's sponges, with their conspicuous color change, seem too different from Nardo's description to come under it. I judge that Nardo had in mind *Spongia officinalis*, but specimens of poor commercial quality, and therefore have designated British Museum No. 83.12.4.28 as neotype of *Aplysina aerophoba* and of *Aplysina*. This specimen, from Nardo's immediate neighborhood, is *Spongia officinalis* and confirms that *Aplysina* falls in synonymy to *Spongia* Linné (1759, p. 1348).

Verongia fistularis is cylindrical, candle size, yellow and spongy alive, but black, stiff, and brittle when dry. The surface is conulose, with a few small oscules; the pores are microscopic. The ectosome is a thin but definite skin, the endosome densely fleshy. The skeleton is a coarse reticulation of fibers that have a distinct large pith or core. The sponge turns first blue violet, then black, as it dies and dries, or in alcohol.

Dysidea etheria

HEAVENLY SPONGE

A.M.N.H. Nos. 466, 480

This was first described by de Laubenfels (1936, p. 28). It is amorphous, often of fist size, sky blue, and is spongy when alive but fragile when dry. The surface is conulose, and the openings are inconspicuous. The ectosome is a thin dermis, the endosome fleshy. The skeleton is a reticulation of fibers that are loaded with foreign material.

Ianthella ianthella, new species

TYPE MATERIAL: Holotype, A.M.N.H. No. 465, collected July 6, 1948, at McAdam Shoal, 12 kilometers east of the town of Bimini, British West Indies, 5 meters deep. Another specimen is A.M.N.H. No. 481.

DESCRIPTION: The shape is massive. The size of each of four specimens was about that of a human head. Several smaller, fist-sized fragments were found. All the specimens were collected by means of a sponge hook within an area of about an acre. The color in life is a vivid carmine red exterior, with a bright lemon yellow interior. Upon dying it slowly turns black. The consistency in life is firm but somewhat spongy. When dead it becomes stiffer; dried specimens are first like leather, finally almost stony hard. The surface is beset with peculiar conules, 7 mm. apart and 3 to 4 mm. high, but not pointed; instead each has an apical, bulb-like knob. Ridges connect the conules, leaving flattened or even concave polygonal areas between them. The oscules and pores are inconspicuous. The ectosome is a definite dermis, distinctly set off in color as well as in morphology. The endosome is densely fleshy, with small flagellate chambers and comparatively small canals. This flesh is amazingly resistant to bacterial action, even long after death must have ensued. An odor of putrefaction appears within a day after removal from water, but sections of the sponge exhibit remarkably little alteration from the appearance in life. The flesh of *ianthella* has a peculiar cheese-like reaction when it is cut with a knife. The skeleton is a chiefly dendritic conglomeration of fibers which are often a little more than 50 microns in diameter. Each fiber has a central pith, which occupies about one-third of its total diameter, and in this pith are numerous objects that certainly seem to have been living cells at the time that the sponge was collected.

The genus *Ianthella* is sharply characterized by these cells within the hollow fibers; no other genus of Porifera has this trait. Other species of *Ianthella* have the peculiar cheese-like consistency and resistance to bacteria; no sponges in other genera have these traits so pronouncedly developed. The species *ianthella* has a skeleton that is more dendritic than is true of many other specimens of the genus. The type of the genus is *flabelliformis*, and it has a reticulate skeleton. It is possible that all the other species that have been published prior to 1948 are really synonyms of *flabelliformis;* if so, then the genus has two published species, the one chiefly reticulate, the other (from Bimini) chiefly dendritic. The differentiation of the present species depends more upon color than upon skeletal pattern. No other specimens of *Ianthella* have at all the peculiar combination of dark red ectosome with the lemon yellow endosome; *flabelliformis* seems always to have been

yellow throughout when alive, turning black after death. The species *ianthella* is, however, most distinctive of all in regard to the peculiar surface conules, with their knob-like terminations. The specific name *ianthella* is selected because there is considerable reason to expect that a new generic name may need to be found for this remarkable sponge. It is my desire that this species shall still show in its name its relationship to the genus *Ianthella*, even if it must eventually be removed to another genus.

Haliclona rubens

A.M.N.H. No. 487

This was first described as *Spongia rubens* by Pallas (1766, p. 389) and transferred to *Haliclona* by de Laubenfels (1936, p. 40). From 1927 to 1936 I found this species abundant around Tortugas, but in 1948 could not find a single specimen there. The only specimen found in the Bahamas in 1948 was collected while wading at the extreme south end of the Bimini group of islets, in about 1 meter depth. Whereas the typical shape for this species is ramose, the Bahaman specimen is hemispherical, fist size, the typical somewhat dull carmine red, and of spongy consistency. The surface is even, with abundant but minute fiber ends protruding; the oscules are scattered, 2 to 4 mm. in diameter, the pores small and numerous. There is no ectosome, and the endosome is reticulate, somewhat bread-like. The skeleton contains loose spicules and fibers that are densely cored with spicules, all of which latter are small oxeas about 4 by 110 microns in size.

Haliclona molitba, new species

The Bimini specimen, A.M.N.H. No. 486, was found growing on eel grass in the lagoon east of the Lerner Marine Laboratory June 30, 1948. I found this species to be common in the Bermudas in the summer of 1947.

HOLOTYPE: Here designated as No. 1948.8.6.15, British Museum.

TYPE LOCALITY: Near Flatts, Bermuda, collected August 7, 1947.

DESCRIPTION: This species is amorphous, usually finger sized or smaller, vivid purple or violet, and very softly spongy, extremely compressible. It is superficially smooth, but somewhat punctiform, with oscules up to 1 mm. in diameter, and pores so large as

to be easily confused with the oscules; they are very numerous. There is no ectosome, and the endosome is chiefly a conspicuous fibroreticulation with scattered bits of flesh on it. The primary fibers are 30 microns in diameter, the secondary fibers are only about half as large, and the meshes are quite irregular in outline. All the fibers are lumpy and contain spicules, although short regions in them may be aspiculous; at the most there are about three spicules per cross section of fiber. Remarkably few spicules occur loose in the flesh; nearly all are embedded. The spicules are simple oxeas about 2 by 100 microns.

The species *molitba* is set off from others of the large genus *Haliclona* by its high ratio of spongin to spicule in the very elastic fibers. It is probably closest to *Haliclona palmata*, originally described as *Spongia palmata* by Ellis and Solander (1786, p. 189), but *palmata* is yellow, where *molitba* is violet, and *palmata* has numerous spicules that are not in the fibers. The name *molitba* is altered from a Bermudan designation, and has no translation from Latin or Greek.

Haliclona viridis

GREEN SPONGE

A.M.N.H. No. 488

First described as *Amphimédon viridis* by Duchassaing and Michelotti (1864, p. 81) and transferred to *Haliclona* by de Laubenfels (1936, p. 42). This abundant sponge is often amorphous, but under favorable conditions may become ramose, with branches up to 15 cm. tall. It is green when alive, but fades upon preservation, and its consistency is soft, weakly spongy. Its surface is much like that of *Haliclona rubens*. There is no ectosome, and the endosome is reticulate, with fibers up to 100 microns in diameter. There are many spicules in the fibers and many outside them as well; these are oxeas about 6 by 150 microns.

Haliclona longleyi[1]

A.M.N.H. No. 489

This sponge was found in the western Bahamas in 1948 only

[1] The species *longleyi* probably will not remain permanently in the genus *Haliclona*. When this genus is later revised, we must erect a new genus, *Neopetrosia*, to have *longleyi* as genotype, differing from *Haliclona* by having a smoother surface, more brittle consistency, and other more important differences which we are not yet ready to discuss.

as a macerated specimen, cast up on the beach just west of the Lerner Marine Laboratory. It is ramose, of thick finger size, bleached nearly white (but dull yellow green in life) and is brittle, nearly as hard as cardboard. The surface is smooth, somewhat velvet-like, with conspicuous oscules and abundant small pores. There is no ectosome, and the endosome is a reticulation of tracts that are packed with spicules. The latter are oxeas about 3 by 120 microns in size.

Cribrochalina infundibula

A.M.N.H. No. 490

This sponge was first described by Schmidt (1870, p. 36) from the West Indies, with the spelling *infundibulum*, but agreement in gender of the adjective species name with the feminine noun genus name requires the spelling *infundibula*. The only specimen found in the western Bahamas in 1948 was a macerated specimen cast up on the beach just west of the Lerner Marine Laboratory. It is a vase or funnel, almost liter-capacity size, bleached nearly white, and is somewhat spongy in consistency. The surface is rough, and there is no ectosome. The endosome is fibroreticulate, and the fibers are cored with many rows of small oxeas. The funnel shape serves to distinguish *Cribrochalina* from its close relative *Haliclona*.

Siphonochalina siphona, new species

TYPE MATERIAL: Holotype, A.M.N.H. No. 468, collected July 1, 1948, in the lagoon east of the Lerner Marine Laboratory, at a depth of somewhat less than 1 meter. Another specimen is A.M.N.H. No. 483. There was in one place a bed of hundreds of specimens of this sort, and others were widely scattered over many acres but difficult to find.

DESCRIPTION: This sponge has the form of hollow cylinders or tubes about 1 cm. in outside diameter, walls about 1 mm. thick, total height often about 5 cm. The basal mass from which the tubes arise is regularly buried beneath the sand, and its total size was never satisfactorily ascertained. It is common for masses of tubes to rise so crowded that they almost touch, and indeed they sometimes not only do touch but fuse laterally at the point of contact. The color is a dull yellow brown, and the consistency is toughly spongy. The surface is relatively smooth. The oscules

may or may not be represented by the apical openings, usually 8 mm. in diameter, of the tubes. All other openings, pores or oscules, are abundant but minute. There is no special ectosome at all, and the endosome is filled with a dense, fine-meshed reticulation of fibers. These consist of a spongin which has much of the same appearance and consistency as the spongin of the commercial sponges, but each fiber is packed with spicules. The fiber diameter is often about 20 microns. The rounded meshes are often only 50 microns in diameter. There is no sharp differentiation of primary fibers, so that one might regard all the fibers as secondary, which is the situation that obtains in the genus *Hippiospongia*. The spicules are simple oxeas, often curved, 2 by 135 microns in size.

The generic allocation of *siphona* is extremely perplexing. The resemblance of the spongin to that found in species within the Order Keratosa renders difficult even the selection of the correct order. Within the Keratosa many fibers become packed with spicules that were picked up from the environment rather than produced by the sponge in which they are found. There is no guarantee that the spicules in the fibers of *siphona* are proper; they too may be foreign, but the universality of their occurrence renders it probable that they are proper. Even assuming this, other problems remain.

The genus name *Siphonochalina* must be employed with great hesitation. It was set up by Schmidt (1868, p. 7) with a diagnosis that obviously includes the present species: pronounced tubular shape and fibers cored with simple oxeas. This combination of characters is also extremely typical of many species of the genus *Callyspongia*. This latter genus is further set off by its possession, whether tubular or solid, of a special dermal skeleton, a fine-meshed network within coarser fibroreticulate structures. Certainly very numerous specimens that have been identified as of the genus *Siphonochalina* are really *Callyspongia*. The critical matter concerns Schmidt's type; which sort of sponge was it? His description gives no clue, and so far as I can ascertain he left no specimen designated as type. Topsent (1925, p. 713) redescribed some specimens identified by Schmidt as *Siphonochalina coriacea* (which is the genotype), but Topsent also neglects to describe the ectosome. If this means that there was no ectosome, then the genus is suitable to receive this Bahaman species.

The species *siphona* differs from *coriacea* in spicule size, inas-

much as the latter's oxeas are described as 5 by 105 microns (by Topsent); *coriacea* is Mediterranean. Further comparisons seem hopeless at present. There are a score of names in the genus, but each of them may be a *Callyspongia* and most of them probably belong to *Callyspongia.* I have studied in the field the sponge faunas of quite a few regions of the world, and—for example in the British Museum—have studied collections from many more regions. When I have studied regions where supposed species of *Siphonochalina* have been reported, I have found many *Callyspongia* but nothing like *siphona,* confirming my suspicion that there are few or no names which properly should remain in *Siphonochalina.* The species *siphona* appears to me to be radically different from any other sponge that I have ever seen, and it is conceivable that a new genus may yet need to be erected to receive it.

Callyspongia fallax

A.M.N.H. No. 485

This sponge was first described by Duchassaing and Michelott (1864, p. 57). It is a branching or ramose sponge; its relatively solid cylinders are about 2 cm. in diameter, but irregular in size and in shape of cross section, as well as crooked. The branches are often about 10 to 20 cm. tall. The color is a pale violet in life and health, but drab specimens occur, possibly pathological; this species turns drab upon dying. The consistency is very spongy. The surface is smooth, with scattered small oscules and abundant minute pores. The ectosome includes a network of spongin fibers about half the size of the fibers of the endosome, in a single sheet over the entire surface, its meshes between a fifth and a half as large as the meshes of the endosomal skeleton. The endosome is a three-dimensional reticulation of strong spongin fibers with rather scanty protoplasmic structures dispersed throughout. The skeleton also includes minute oxeote spicules, chiefly embedded in the fibers.

Other ramose or branched, bush-like sponges of a similar lavender color occur in the West Indian region, especially *Haliclona variabilis;* also the somewhat richer colored *Haliclona molitba* must be kept in mind in this connection.

From all these others, if they do now or in the future should ever occur in the vicinity of the Lerner Marine Laboratory, one may discriminate by study of the surface layer. Members of the genus

Callyspongia do have the fine dermal fiber net, or small-meshed net inside the meshes of the coarser net. Members of the genus *Haliclona* have no special ectosome at all.

There is some possibility that *fallax* may be conspecific with the following species, *vaginalis;* if so, it would fall in synonymy, because the name *vaginalis* is earlier. It is here, however, still maintained (although with hesitation) that the solid specimens of *Callyspongia* are specifically distinct from the hollow ones.

Callyspongia vaginalis

TUBE SPONGE

A.M.N.H. No. 484

This species was first described as *Spongia vaginalis* by Lamarck (1814a, p. 436) and transferred to *Callyspongia* by de Laubenfels (1936, p. 56).

Rarely this sponge comprises a single hollow cylinder or narrow vase, but usually one finds six or more such tubes rising from a single small base. They are fairly often in a single plane, but radiate a little like a fan. Where two tubes touch laterally they often coalesce. The tubes are usually about 5 cm. in outside diameter, with walls 5 to 10 mm. thick. The color in health is violet; dead specimens fade to drab, and all or portions are frequently found in the field to be drab. These may be pathological or already moribund; the skeleton is so durable that it persists after death and disintegration of its protoplasmic precursor. The consistency is very spongy. The surface is smooth, or, more often, it is even but elevated into coarse, cone-shaped protrusions. These should not be confused with the conules of keratose sponges. For the latter, the skin is lifted over protruding fiber ends. For *Callyspongia* the entire sponge structure grows out into the large conular elevation.

The oscules may be regarded as being the huge apical openings of the central hollows, or instead may be regarded as being the many openings, about 4 mm. in diameter, from the walls into the central cavity or cloaca. The pores are the myriad minute openings in the external surface network.

The ectosome is a fine net within the meshes of a coarse fiber reticulation, as described above for the species *fallax*. The endosome and spicules are also as in *fallax*.

Agelas sparsus

A.M.N.H. No. 482

This was first described as *Ectyon sparsus* by Gray (1867, p. 515) and transferred to *Agelas* by de Laubenfels (1936, p. 74). The only specimen found in the western Bahamas in 1948 was a macerated specimen cast up on the beach just west of the Lerner Marine Laboratory. Dried, macerated specimens of *sparsus* look amazingly like similarly prepared sponges of the commercial varieties, are massive to amorphous, often double fist size, drab, and very spongy. The surface is undulating, full of many small apertures. The ectosome is a sort of skin, and the endosome a dense fibroreticulation. The spicules are acanthostyles of a distinctive sort, with the spines arranged in a series of nodes. All or nearly all of these spicules protrude from the abundant spongin fibers, only the head of the spicule being embedded in the fiber.

Xytopsene sigmatum, new species

Type Material: Holotype, A.M.N.H. No. 469, collected July 1, 1948, in the lagoon east of the Lerner Marine Laboratory, at a depth of about 50 cm. It is also represented by A.M.N.H. No. 491.

This species was found growing in sand where there was no eel-grass close by and seemed to be rather common in the southern portion of the lagoon, but was difficult to find. Only the bright orange tips (with the oscules) would show above the level of the sand, all the rest being buried. Actually the main mass of the sponge is firmly attached to rock. It is not known if the partial covering by sand is to be expected, or if it is merely accidental.

Description: The species *sigmatum* is amorphous to massive with the conical elevations several centimeters high, the whole mass about fist size. The color is bright golden orange and the consistency softly spongy. Upon handling or dying, great quantities of colloidal exudate are given off. The oscules are about 4 mm. in diameter (but contractile); the pores are minute and abundant. There is a slight skin-like dermis. The endosome is chiefly in confusion, but there are some spicule-packed tracts scarcely to be called fibers, and the deeper portions of the sponge contain considerable quantities of sand and other foreign material. The spicules consist of megascleres and microscleres. Of the former there seems to be but one sort, a tylote with each end about

equally enlarged and rounded. The size is often 4 by 220 microns, but may reach 340 microns in length. The microscleres comprise two sizes of sigmans, the larger 60 microns in chord measurement, the smaller ones 15 microns in chord measurement. There are also chelas, 20 microns long, probably to be regarded as arcuate, but verging towards the palmate in shape.

The species *sigmatum* is the only one so far described and located in this genus that has sigmas. The other three species are all found in the Indian Ocean, and Australian region, and have larger megascleres, but very similar shape. All three are more or less pinkish or red rather than yellow.

Axociella spinosa

A.M.N.H. No. 492

This species was first described as *Microciona spinosa* by Wilson (1902, p. 396) from Puerto Rico. It was transferred to *Axociella* by de Laubenfels (1936, p. 113). Only one specimen of this sponge was certainly collected in the western Bahamas in 1948, on July 3, in the lagoon east of the Lerner Marine Laboratory, at a depth of about 1.5 meters. It was a thin crust on another sponge. On the same day a crab was collected, having a very thin red crust on its shell, and it may be that this crust was a second specimen of *spinosa,* but the material was too scanty for sure identification.

The present species is encrusting, almost paper thin, red, and of mediocre consistency. Its surface is minutely spiny, with only extremely minute openings. It is so thin that one can scarcely differentiate ectosome from endosome or vice versa. The skeleton comprises smooth subtylostyles (7 by 240 microns) for megascleres, with toxas (60 microns) and palmate isochelas (15 microns) for microscleres. In Wilson's specimen, some of the styles were more than twice as thick as those in the Bimini specimen, but many were about as thin, and in other respects the agreement is quite close.

Tedania ignis

FIRE SPONGE

A.M.N.H. No. 493

This species was first described as *Thalysias ignis* by Duchassaing and Michelotti (1864, p. 83) and transferred to *Tedania* by

Verrill (1907, p. 339). It is superabundant through the West Indies and notorious for the skin irritation that many people obtain whenever they touch it. This dermatitis is evidently of chemical origin and may be compared to the effects of poison ivy (*Rhus toxicodendron*).

The shape is amorphous to massive, often fist size but occasionally even head size, bright red externally, but somewhat paler and duller inside, soft and easily torn. The surface is smooth. The oscules are often over 1 cm. in diameter and characteristically are raised on conical elevations several centimeters high. The pores are noticeable and abundant. The ectosome is a denser flesh than the endosome and is packed with special spicules. The endosome is rather like a crumb of bread with only vague spicular tracts. The dermal megascleres are tylotes about 4 by 185 microns, heads microspined. The endosomal spicules are smooth styles about 6 by 215 microns. The microscleres are microspined raphides, 1 micron or less in thickness, and up to about 135 microns long.

Pseudaxinella rosacea

A.M.N.H. No. 494

This species was first described as *Axinella rosacea* by Verrill (1907, p. 341). It is common in the Bermudas, but only two specimens were found in the western Bahamas in the summer of 1948. It is massive. The two Bimini specimens were cylindrical, but this form seems never to occur in Bermuda. They were of large finger size, red to orange red, and spongy. The surface is coarsely roughened, and each protrusion is in turn covered with yet smaller protrusions. The oscules and pores occur in the valleys between the elaborate and abundant protrusions. There is no special ectosome, and the interior is a rather confused mass of spicules, with some spongin fibers. The protoplasmic structures very readily come off the skeleton when the sponge is dead. There are two sorts of spicules, oxeas and styles, each about 5 by 150 microns, but with considerable variation.

Higginsia coralloides

A.M.N.H. Nos. 470, 495

This species was first described by Higgin in 1877 (p. 291) and seems to be a very widely distributed sponge, even occurring in

the Eastern Hemisphere. In the western Bahamas it seems to be most abundant at depths of more than 3 meters, especially south and east of Bimini. I collected it July 3, 1948, while using the diving helmet. It is ramose, with branches 2 to 3 cm. thick and up to 20 cm. high; bright red orange in color and toughly spongy in consistency. The surface is compound roughened, as in the preceding species, with protrusions 2 to 5 mm. high that are in turn covered by smaller protrusions. The oscules and pores are in the valleys between the protrusions and are very inconspicuous. There is no special ectosome. The endosome is plumose, with an axial skeleton that is surrounded by radiating, plumose tracts or fibers. The skeleton comprises both spongin fibers and abundant spicules, many of which echinate the fibers or are at surface brushes or tufts. The megascleres are medium sized, say 16 by 360 microns, and include both styles and oxeas. The microscleres are rather strongly spined raphides, about 2 by 80 to (rarely) 3 by 150 microns in measurement.

Spheciospongia vesparia

MANJACK SPONGE

This was first described as *Alcyonium vesparium* by Lamarck (1814b, p. 78) and was transferred to *Spheciospongia* by Marshall (1892, p. 32). This abundant West Indian sponge grows to a larger size than does any other sponge in the world. East of Bimini, especially near McAdam Shoal, specimens were observed to be well over a meter in diameter, great, massive, cake-shaped sponges, dark brown or black, and cork-like or woody in consistency. The surface is rather smooth, not at all conulose. The oscules are chiefly on the top, and very large, even as much as 7 cm. in diameter. There are clusters of holes on the sides of the sponge. Each cluster is a sieve over a large canal that is a little more than a centimeter in diameter, the sieve comprising a dozen or more holes, each about 2 mm. in diameter. It is not clear whether these sieve-covered canals are inhalent or exhalent, probably the former. There are many minute, pore-like surface openings in addition to the larger ones. The ectosome is a dense cortex about 3 mm. thick. The endosome is coarsely cavernous, with huge canals, 10 to 40 cm. long and often nearly 3 cm. in diameter. There are spicule-packed tracts some 2 or 3 mm. in diameter, but most of the spicules are just packed densely throughout

the flesh. The megascleres are tylostyles 9 to 10 microns in diameter, 400 to (rarely) 600 microns long; 10 by 450 is a common size. The microscleres are rare and difficult to find, often occurring only at the extreme surface; they are spirasters some 12 to 15 microns long.

Juvenile specimens of *Spheciospongia* are sometimes little more than black, finger-sized hollow cylinders. Others are thumb-like, sieve covered, and dark brown.

Spirastrella coccinea

A.M.N.H. No. 498

This was first described as *Thalysias coccinea* by Duchassaing and Michelotti (1864, p. 84). It is an encrusting sponge, often paper thin but spreading indefinitely laterally. It is red to reddish brown in color and of mediocre consistency. It is smooth, with only very minute oscules and pores. The ectosome is packed with the microscleres; the endosome contains some microscleres, but chiefly megascleres in confusion. The latter are tylostyles about 6 by 360 microns. The microscleres are spirasters 2 by 12 to 4 by 20 microns in size.

Most of the common, thin, red orange, or red brown encrusting sponges around Bimini seem to belong to *Spirastrella*, but some other genera do occur, such as *Axociella*, and look very much like *Spirastrella*.

Anthosigmella varians

DINGY SPONGE

A.M.N.H. No. 499

This species was first described as *Thalysias varians* by Duchassaing and Michelotti (1864, p. 86) and was transferred to *Anthosigmella* by de Laubenfels (1936, p. 143). It is extremely abundant in the vicinity of the Lerner Marine Laboratory. It has quite a variety of shapes, sometimes elongate and cylindrical, again merely massive or amorphous. Some specimens are nearly as large as a human head, but fist or finger-sized specimens are more common. The color is a dingy brown, varying from dirty dark yellow to walnut brown. The consistency is mediocre, or perhaps to be compared to that of cheese. The oscules and pores are very small. The ectosome is denser than the endosome and is packed with spicules whose points are often directed towards the

surface. The endosome is moderately cavernous, the solid portions being packed with megascleres in confusion. These spicules are tylostyles about 6 by 360 microns; rarely they are styles or centrotylote styles. The microscleres are very distinctive. They are essentially spirasters with blunt, knob-like protrusions instead of the usual sharp spines. They have usually only one C-shaped curve but sometimes a more normally twisted spiral shape. In most spirasters the spines form a spiral that twists around the axial rod, or are so numerous that they cover it. In *varians* they usually make a simple row that does not wind around the axial rod. Typically they are arranged only along the convex side of the spicule. In Florida I have found specimens of *varians* in which about half the microscleres seemed to be nearly like normal spirasters, but the exact figure is problematical because the typical, peculiar *varians* microsclere looks rather like a formal spiraster when it is viewed from the convex side. In the vicinity of the Lerner Marine Laboratory nearly all the specimens had almost exclusively the typical *varians* microscleres.

Cliona vastifica

BORING SPONGE

A.M.N.H. Nos. 472, 497

This species was first described by Hancock (1849, p. 343). It is widely distributed throughout the world, although in most of the Americas it is greatly outnumbered by *Cliona celata* and other species. At Bimini the only boring sponge seems to be *vastifica*. Its galleries or tunnels are about 0.8 mm. in diameter, and often so abundant that they are only 3 mm. apart, center to center. Unlike *celata*, *vastifica* seems never to grow on up out of the calcareous material in which it bores; *celata* often makes huge head-sized masses. The color of *vastifica* is orange rather than yellow; of course the consistency is obscured by the boring habitus. The surface, the oscules, and the pores are all minute structures at the openings to the galleries. There is, for the same reason, no sharp distinction between ectosome and endosome. The spicules are tylostyles 2 by 220 to (commonly) 4 by 300 microns. The microscleres are of two sorts, long, thin, microspined raphides and short, more heavily spined microxeas, say 10 to 20 microns long.

Cryptotethya crypta, new species

TYPE MATERIAL: Holotype, A.M.N.H. No. 473, collected July

3, 1948. Numerous other specimens were collected in June and July, both east and west of Bimini, including A.M.N.H. No. 500.

That this species has not previously been found in spite of its relative abundance may be owing to its tendency to grow almost or quite buried. We used a dredge that bit into the bottom in 1948. In places where the dredge readily brought up specimens, none could be seen with the water-glass nor when walking over the bottom using a diving helmet.

DESCRIPTION: This is an amorphous sponge, often of fist size, or slabs 4 by 7 by 12 cm. The color is blackish green to drab. The consistency is wood-like. The surface is given over to low convex areas, somewhat suggestive of the surface of *Tethya*, which is interesting inasmuch as the megascleres are so much like those of *Tethya*. The pores and oscules are minute, yielding the so-called lipostomous condition. This would be an expected concomitant of successful growth under sand, because sand would occlude larger openings. The surface over the lumps is smooth, even slippery, and glossy. There is a fibrous cortex or ectosome, but so vague that its thickness, perhaps about 1 mm., is difficult to measure. The endosome contains some foreign matter, such as sand grains, and ascending tracts that are densely packed with spicules. There is one such tract for each dermal convexity; the tract diameter is over 1 mm., and their distance apart is about 5 mm. The megascleres are strongyloxeas as in *Tethya*, about 20 by 900 microns. There are two sorts of microsclere: abundant chiasters about 15 microns in diameter, and less common larger asters about 40 microns in diameter. These latter have only a few rays, say 7 to 14, and most of these rays are just barely but definitely branched at their distal ends.

In 1936 (p. 161) I put *Cryptotethya* in the family Jaspidae. The present specimen seems enough like *Tethya* for one to think it belongs in the family Tethyidae. It is more like *Tethya* than are the other two species of the genus, both of which are instead more like *Jaspis*, with definite oxeas instead of strongyloxeas. Furthermore they had only the chiasters; it may well be that a new genus should be erected for this Bimini sponge.

Cinachyra cavernosa

A.M.N.H. No. 501

This species was first described as *Tethya cavernosa* by Lamarck

(1814b, p. 70) and was transferred to *Cinachyra* by Topsent (1931, p. 5). In 1948 I found this only to the west of Bimini at 5 to 10 meters. It is massive to subspherical, often of fist size, bright golden yellow or orange, and cartilaginous in consistency. Its surface is strongly hispid, with large concavities, often large enough to contain grains of rice or even small beans. Many of these have proved to be porocalyces, that is to say, inhalent chambers from which many pores open. Most or all of the oscules are quite small. The ectosome is a fibrous cortex, the endosome radiate, spicule packed, and dense. The spicules are chiefly enormous oxeas, but a few slender protriaenes and anatriaenes occur. The microscleres are microspined sigmaspires, about 15 to 20 microns long.

Geodia gibberosa

A.M.N.H. No. 502

This species was first described by Lamarck (1815, p. 334). In 1948 I found this species only to the west of Bimini, at 5 to 10 meters depth. Like *Cinachyra* it may occur in shallow water. It is massive to subspherical, often of fist size, occasionally larger. It is fundamentally white, but usually soiled by its environment. It is stony hard. The surface is rather smooth, with little clusters of pinprick-sized holes. Some of these may be inhalent, others exhalent. The ectosome is a hard armor, made of billions of siliceous sterrasters held together by tough fibers. It is not thought that these fibers should be called spongin. The endosome is semiradiate, much confused. The megascleres are giant oxeas and orthotriaenes of the same size range (diameters 30 or more microns, lengths several millimeters). The dermal sterrasters are about 50 microns in diameter; the endosomal spicules include juvenile sterrasters, a few oxyeuasters about 30 microns in diameter, and many spherasters only 2 to 5 microns in diameter.

Chondrilla nucula

Chicken-liver Sponge

A.M.N.H. Nos. 474, 503

This was first described by Schmidt (1862, p. 39). It is extremely abundant, not only at Bimini but also throughout the West Indies, particularly in very shallow water. It is subspherical to amorphous; large specimens seem encrusting because they grow

far laterally. The thickness is usually about 5 cm., but the width may be many times as great. The color is always dull, varying from pale drab to dark. The consistency is cartilaginous. The surface is slippery, shiny smooth. The oscules are several centimeters apart, may open to 2 mm. but close readily and then can scarcely be found. The ectosome is a dense cortex; the endosome is sharply defined but nearly as dense. The skeleton is chiefly a colloidal gel, but microscleres are present. These are spherasters about 30 to 40 microns in diameter.

There is a Mediterranean sponge named *Chondrosia reniformis* by Nardo (1847, p. 23). It may be that this is merely a *nomen nudum* in Nardo, in which case credit should be given to the first recognizable description, which is Schmidt (1862, p. 40). This species is like *Chondrilla nucula* except that it has been said to have no spicules at all. Now we must throw its nature open to question.

In 1948 near the Lerner Marine Laboratory I found specimens of this sort in which spicules were so rare that at first I could not find any. Sections studied under the microscope revealed none. The usual technique in searching for spicules is to boil out a small fragment with fuming nitric acid and examine the debris. I did this and there were no spicules. Then it so happened that Prof. Werner Bergmann boiled out a larger quantity of this sponge, which I had considered to be a *Chondrosia*. From about a cubic centimeter of sponge he obtained a suspension, which was centrifuged, and in the precipitate there were literally hundreds of *Chondrilla*-type spherasters.

Are *nucula* and *reniformis* congeneric or even conspecific? What would one find by similar wholesale study of Mediterranean specimens of certainly *reniformis*? If the two are congeneric, the name *Chondrilla* must fall to the earlier *Chondrosia*. It may be that both names may be retained, on the slender margin of separation that in *Chondrilla* the spicules are abundant, and in *Chondrosia* they are very rare. On this basis we would have *Chondrosia reniformis* in the western Bahamas, the thirtieth species collected in 1948.

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A REVISION OF THE SPECIES OF THE GENUS *POLYCESTA* OCCURRING IN THE UNITED STATES (COLEOPTERA, BUPRESTIDAE)[1]

BY WILLIAM F. BARR[2]

INTRODUCTION

The buprestid beetles belonging to the genus *Polycesta* have long been of interest to coleopterists because of their scarcity, their interesting discontinuous distributional pattern, and their unique appearance. The classification of these insects, however, has not been well established, primarily because of the variation of structural characters many of them exhibit, but also because the distribution of each of the species has not been clearly understood.

With the hope of finding stable taxonomic characters that could be used as a basis for species classification, a study was made of the male genitalia of the members of this genus known to occur within the boundaries of the United States. Differences in the structure of this organ have been found that allow for a ready differentiation of the species. Nearly 400 specimens have been examined. From these, distributional and external morphological data have been gathered and analyzed. These data have also helped immeasurably to clarify the species problem present in this genus. The correlation of the genitalic differences with the more constant external morphological differences, together with the existing distributional and biological data, will, it is hoped, place the taxonomy of the United States species of *Polycesta* on a firmer basis than formerly.

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The present paper recognizes 11 species as occurring in the United States, four of which are described as new.

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DISTRIBUTION

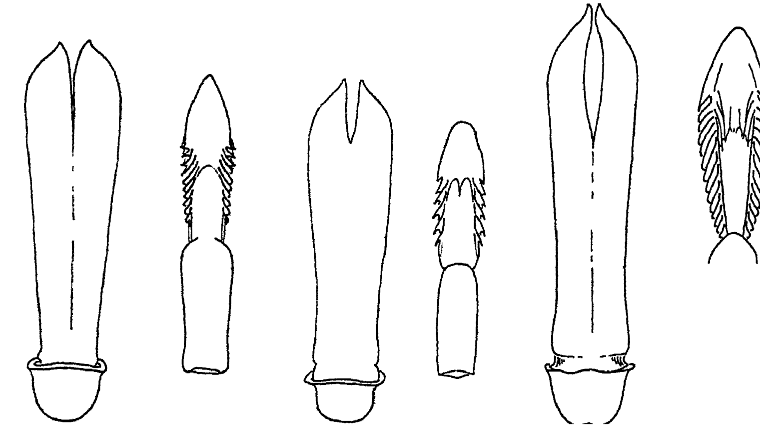
Approximately 45 species are now recognized as belonging to the genus *Polycesta*, the majority of which occur in the New World. Two species have been described from China, and eight are known from Africa. In the Western Hemisphere the largest number of species are recorded from the tropical and subtropical areas of the West Indies and Central and South America, with only a comparatively few ranging into the temperate regions. Eleven species are known from the United States, two of which also occur outside its boundaries. Of these, *P. angulosa* is known only from Cuba and Florida, while *P. velasco* ranges throughout the southwestern United States and Sonoran Mexico. With regard to the remaining nine species endemic to the United States, three do not occur in the state of California. *P. abdita* is known only from the Florida Keys, *P. elata* occurs in Texas and Arkansas, and *P. arizonica* presents a spotted distributional pattern in Arizona, New Mexico, and western Texas. Of the California species, only one, *P. californica*, also occurs outside the limits of this state. It ranges along the Pacific coast north into Oregon and possibly Washing-

ton. However, in the southern half of California it occurs in a sympatric manner with five species which are endemic to this region. Thus it is seen that six species of *Polycesta* are rather closely associated with one another within a fairly small area. This area, which is west of the true desert regions, extends north from San Diego County in two forks. One follows the coast range up to the vicinity of the Mt. Hamilton Range, and the other follows the inland mountain ranges up to the Sequoia National Park region. At present, the distribution of the six species within this area is not fully understood, and additional collections are needed in order to bring about a clarification of the problem and the factors responsible for it. However, from a study of available specimens it has been noted that *P. californica* and *P. crypta* seem to occur throughout the greatest part of this area, *P. hageni*, *P. cazieri*, and *P. cyanea* appear to be restricted to certain parts of it, while *P. tularensis* is known only from two widely separated localities, each in the northern part of each fork.

PHYLOGENY AND SPECIATION

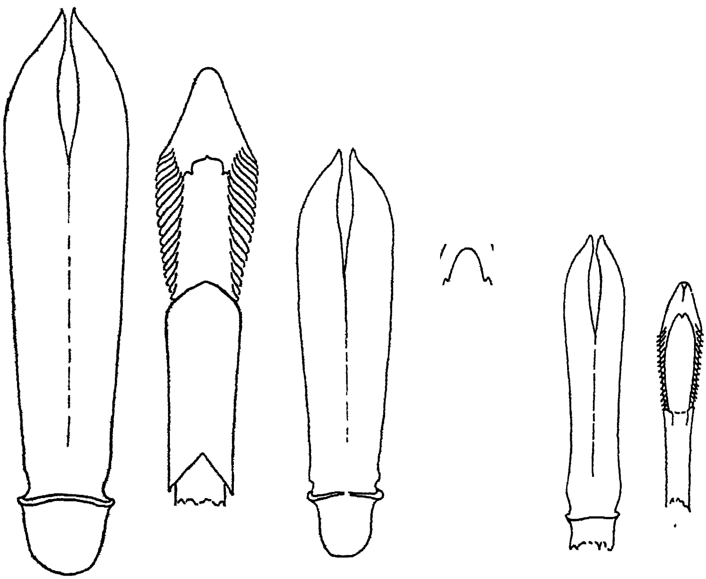
On the basis of morphological characters, the United States species of *Polycesta* are readily separated into three well-defined groups, those of *abdita*, *arizonica*, and *elata*. The presence of pronotal depressions, structure of the elytral costae, shape of the hind margins of the abdominal sternites, and the structure of the male genitalia are the characters that have been used to form the basis upon which the groups have been separated. These characters have also been used as indicators of the degree of group relationships.

The *abdita* group, which includes *P. abdita* and *P. angulosa*, is quite distantly related to the others. Its affinities are with the West Indian forms which have not been available for study and thus it will not enter into this discussion. However, it must be pointed out that the *abdita* group does show a slight relationship to the *elata* group by possessing several characters in common with that group. The pronotum has a longitudinal median depression in each, but in the case of the former, the lateral depressions are just behind the front angles of the pronotum while in the latter they are just behind the middle. The shape of the hind margins of the abdominal sternites also shows some similarities, as do the male genitalia.



A B A B A B

1-P. ABDITA 2-P. ANGULOSA 3-P. ARIZONICA



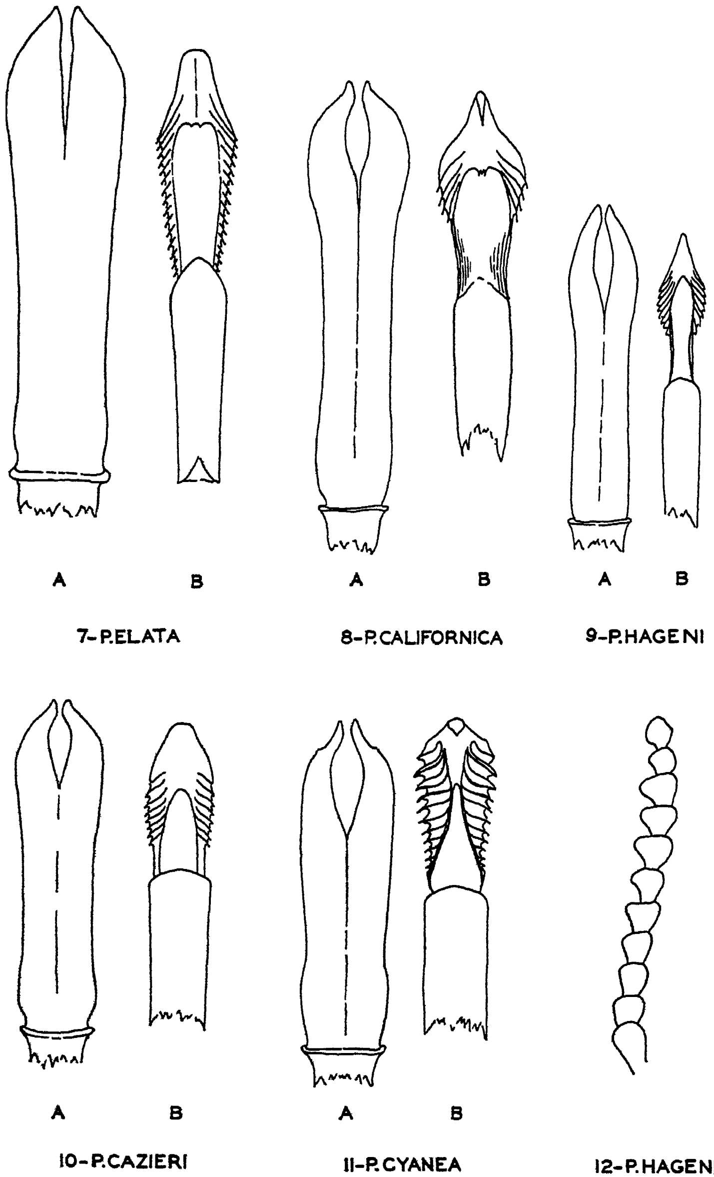
A B A B A B

4-P. VELASCO 5-P. TULARENSIS 6-P. CRYPTA

FIGS. 1–6. Dorsal views of the male genitalia of the species of *Polycesta*. A. Lateral lobes. B. Median lobe.

An even weaker relationship appears to exist between the *arizonica* and *elata* groups. Apparently the *arizonica* group broke off from the others at a very early date; however, the structure of the male genitalia indicates common ancestory. Only two species are known from the *arizonica* group, *P. arizonica* and *P. velasco*, the latter being the more specialized. Apparently, *P. arizonica*, or more likely its basic stock, occupied a wide, continuous range in the southwestern United States prior to the advent of the arid desert areas during the Miocene. With increasing aridity it is possible that this species, with its host plants, was forced into the isolated spots it now occupies in the Southwest. However, in response to aridity *P. velasco* developed and was able to inhabit the great desert areas of this region.

This aridity apparently brought about changes in the *elata* group as well. First of all, however, it must be noted that the *elata* group may be further divided into distinct subgroups, *elata*, *californica*, and *crypta*. The basic stock of these subgroups probably occupied the same general area as the basic stock of the *arizonica* group. When the arid conditions were manifested it was unable to adapt itself to these conditions and thus was forced westward and eastward away from the arid regions. East of the deserts, *P. elata* developed from this basic stock. This species shows closer affinities to the members of the *abdita* and *arizonica* groups than do the other species in the *elata* group. West of the deserts the *californica* and *crypta* subgroups have arisen. The *californica* subgroup contains *P. californica*, which has been able to occupy very large areas of California and Oregon, and the specialized and closely related *P. hageni*. This latter species has broken away from the *P. californica* stock in response to the more or less arid conditions present along the western margin of the Great Basin region in the vicinity of the southern Sierra Nevada Mountains. The *crypta* subgroup occurs only in a rather small area in southern California and yet is represented by four rather specialized species. *P. crypta* is the most primitive of these and occupies more of this area than the others. *P. tularensis* has become more or less stabilized morphologically and is known only from two limited areas. *P. cazieri* and *P. cyanea* are very closely related but are geographically distinct. Both are undergoing considerable evolutionary change at the present and appear to have developed along a separate line from that of *P. tularensis*.



FIGS. 7–11. Dorsal views of the male genitalia of the species of *Polycesta*. A. Lateral lobes. B. Median lobe.

FIG. 12. Antenna of *P. hageni*.

CLASSIFICATION

GENUS **POLYCESTA** SOLIER

Polycesta SOLIER, 1833, Ann. Ent. Soc. France, ser. 1, vol. 2, p. 281. MANNERHEIM, 1837, Bull. Soc. Nat. Moscou, vol. 7, p. 36. CASTELNAU AND GORY, 1837, Histoire naturelle . . . des insectes coléoptères, buprestides, vol. 2, p. 1. LACORDAIRE, 1857, Genera des coléoptères, vol. 4, p. 62. MARSEUL, 1865, L'Abeille, vol. 2, p. 258. LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia, (1858), vol. 10, p. 68. LECONTE AND HORN, 1883, Smithsonian Misc. Coll., no. 507, p. 199. KERREMANS, 1893, Ann. Ent. Soc. Belgique, vol. 37, p. 113; 1902, *in* Wytsman, Genera insectorum, fasc. 12, no. 1, p. 25; 1904, Monographie des buprestides, vol. 1, p. 469. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 23. BURKE, 1917, Bull. U. S. Dept. Agr., prof. papers, no. 437, p. 6. FISHER, 1919, Proc. Ent. Soc. Washington, vol. 21, no. 4, p. 91. GOOD, 1925, Ann. Ent. Soc. Amer., vol. 18, p. 270. FISHER, 1925, Proc. U. S. Natl. Mus., vol. 65, p. 6. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 230; 1933, Jour. New York Ent. Soc., vol. 41, p. 37.

Lycaste GISTL, 1834, Die Insecten-Doubletten aus der Sammlung des Rudolph von Jenison-Walworth. MANNERHEIM, 1837, Bull. Soc. Nat. Moscou, vol. 7, p. 36.

Nemaphorus SOLIER, 1851, *in* Gay, Historia fisica y politica de Chile, Zoologia, vol. 4, p. 490.

Body more or less robust to elongate, feebly convex, attenuate posteriorly, blackish or dark bronze in color. Head vertical; front flat or slightly concave, with or without a median carina which may take the form of an inverted "Y"; clypeus variable in front, truncate or emarginate; antennal cavities rather small, round, completely closed, bordered posteriorly by a narrow carina; antennae rather slender, variable, first segment elongate, moderately clavate at apex, second segment short, third segment rather subcylindrical, longer than second, fourth segment moderately clavate, serrate from fifth segment, segments gradually becoming more serrate and shorter in length from fifth to eleventh segments, eleventh segment rounded at apex; eyes rather large and convex, elliptical, rather narrow, much closer to each other at vertex than at bottom. Pronotum transverse; sides broadly rounded to angulate; hind margin bisinuate, fitting closely to elytra; disk flattened or with median and lateral depressions. Scutellum visible, small, usually convex and oval in shape. Elytra usually coarsely punctured with a variable number of elevated longitudinal costae; sides more or less sinuate near base, usually serrate near apex. Prosternum broad, rather convex; front margin more or less truncate or feebly bisinuate; prosternal process rather broad and flat, sides parallel to behind front coxae,

apex broadly rounded. Sternal cavity formed entirely by mesosternum which is deeply emarginate in front, the lateral branches broad and diverging, expanded at apices. Posterior coxae rather narrow and feebly dilated internally; front margin more or less transverse, strongly sinuate; hind margin broadly arcuately emarginate, often feebly sinuate, notched near trochanter. Abdomen with sutures between sternites variable in shape. Legs moderately long; femora robust to moderately flattened, feebly bowed; tibiae elongate, cylindrical, feebly bowed, apices slightly dilated, bearing a pair of spines; tarsi compressed and feebly developed, first segment moderately elongate; second and third segments triangular and about equal in length, third with or without a membranous lobe beneath, fourth segment rather broad, strongly triangular, with a membranous lobe beneath, fifth segment elongate, obconical, tarsal claws simple.

GENOTYPES: Of *Polycesta*, *Buprestis porcata* Fabricius; of *Lycaste*, unknown; of *Nemaphorus*, *Nemaphorus costatus* Solier.

The genus *Polycesta* belongs to the tribe Acmaeoderini and is represented in the United States along with five other members of this tribe, *Chrysophana*, *Acmaeodera*, *Acmaeoderoides*, *Ptosima*, and *Paratyndaris*. From these it differs by having simple tarsal claws. In general it may be further differentiated by its larger size, blackish or bronze color, and by its costate and coarsely punctured elytra.

Apparently the members of this genus are in a state of evolutionary plasticity at the present, which accounts for the rather great variation within the species and for the difficulties which have been encountered in attempting their classification.

DISCUSSION OF CHARACTERS

HEAD: The front may be concave, flattened or slightly convex, with or without a median longitudinal carina. In *P. elata* this carina takes the form of an inverted "Y." With *P. californica* there may be a small, smooth callosity above the base of each antenna. The front margin of the clypeus is either truncate or emarginate, but too variable to be of much value as a taxonomic character. The occiput bears a small, smooth median area which contains a fine impressed line in several species. Nearly all the species have the antennal segments longer than broad, shining and shallowly reticulate; however, the antennal segments

of *P. hageni* (fig. 12) are opaque and more deeply reticulate, with segments four to seven distinctly broader than long.

PRONOTUM: The general shape is rather variable, but several species may be identified by the degree of expansion of the side margins and whether they are angulate or broadly rounded. Several excellent characters are to be found on the disk. The *arizonica* group has the disk flattened along the middle, but the extreme base may be slightly depressed. The *abdita* group has a broad median depression extending from the base to the front margin, and in addition there is a feeble, round, lateral depression just behind the front angles. The *elata* group also has a broad median depression extending from base to apex, but the small, round lateral depressions are behind the middle near the expanded side margins. The punctuation of the disk may aid in separating species, depending primarily on the placement and abundance of the punctures.

SCUTELLUM: There are definite differences in the shape of this structure between widely separated species. However, the scutellum is in general too variable to be of much value in distinguishing closely related species.

ELYTRA: These are of great importance for they offer differences in shape, punctuation, number of costae, and, to a lesser extent, the nature of the apical spines. In a few species the lateral margins more or less gradually taper from the apical third to the apices, presenting a slender appearance. In others the lateral margins are much more abruptly descending to the apices, giving the insect a much more robust appearance. The elytra of *P. angulosa* are very coarsely and deeply punctured, while those of the majority of the remaining species are rather coarsely and more shallowly punctured. *P. velasco* has the elytra rather indistinctly punctured, the punctures being quite shallow. Nearly all of the species have three entire longitudinal costae on each elytron, *angulosa* normally has only one, while *velasco* has all of the interstrial spaces costate. The short scutellar costae, those that arise at the base of the elytra between the suture and the first main interstrial space and extend somewhat obliquely to near the basal third of the suture, are present in the *abdita* and *arizonica* groups. However, they are usually only faintly indicated on *P. angulosa*, and are entirely absent in the *elata* group.

PROSTERNUM: Differences may be seen in the shape of the

front margin of the prosternum, but they are not present to the degree which warrants their use at the present time.

LEGS: The hind margin of the posterior coxae presents differences in the degree of emargination between the species. These differences are too gradual between closely related species to be used as a taxonomic character in this paper. Both the *abdita* and *arizonica* groups have a broad membranous lobe beneath the third and fourth tarsal segments. However, in the *elata* group, this lobe is absent from the third tarsal segments and is present only beneath the fourth tarsal segments. *P. tularensis* has this lobe considerably reduced in size.

ABDOMEN: In two of the groups the males and females may be readily distinguished on the basis of the character of the first abdominal sternite. In the *abdita* group the males have a dense patch of yellowish pubescence at the middle of this sternite; the females lack this dense patch. In the *elata* group the males have the first abdominal sternite swollen longitudinally along the middle, especially towards the base. This area on the females is quite distinctly flattened. The shape of the hind margins of the first, second, and last abdominal sternites may be of considerable importance in separating species. Moreover, the last abdominal sternite may be used to separate the males and females of all groups. In general, the apex of the last abdominal sternite is much more narrowed and more prolonged in the males.

GENITALIA: All the species may be readily separated on the basis of differences in the male genitalia (figs. 1–11). The more important differences are to be found on the median lobe, which necessitates its removal from the lateral lobes. The presence and character of lateral plate-like structures on the median lobe and its general shape are of primary importance in separating species, and the general shape of the lateral lobes may also be of value. The genitalia show variation within a single species, as would be expected. The extremes of this variation have been associated with the typical forms very easily in all cases.

KEY TO THE SPECIES

1. Pronotum with a broad median depression and an inconspicuous lateral depression behind front angles, sides angulate; male with a densely pubescent, yellowish spot at middle of first abdominal sternite. Florida. 2

— Pronotum without depressions or with a broad median depression and a small lateral depression behind middle, sides broadly rounded; male

without a pubescent spot on first abdominal sternite. Pacific coast states and southwestern United States............................3

2. Black, elytra piceous or ferrugineous; each elytron with two or three entire longitudinal costae, rather densely punctured, punctures rather coarse and round, forming striae between costae, scutellar costa distinct..*abdita*

— Black with distinct aeneous tinge; each elytron with at most two entire longitudinal costae, densely punctured with very coarse deep punctures, scutellar costae usually faintly indicated.....................*angulosa*

3. Pronotum without distinct depressions, at most the disk may be flattened; elytra with distinct scutellar costae; third and fourth tarsal segments with membranous lobes beneath.................................4

— Pronotum with a broad median and narrow lateral depressions behind middle; elytra with the short scutellar costae obsolete; only fourth tarsal segments with membranous lobes beneath.....................5

4. Elytra black with reddish green luster, alternate interstrial spaces costate, apices widened internally..................................*arizonica*

— Elytra shining black, all interstrial spaces elevated, apices not widened internally..*velasco*

5. Antennae slender, shining, segments four to seven longer than broad.......6

— Antennae short, rather dull, segments four to seven broader than long.*hageni*

6. Upper surface bronze, body more or less elongate; lateral margins of elytra gradually tapering to apices; front of head carinate..................7

— Upper surface black, body usually more or less robust; lateral margins of elytra more abruptly descending to apices; front of head with or without a median carina..8

7. Larger (15 to 25 mm.); front of head with an inverted Y-shaped median carina; hind margins of second, third, and fourth abdominal sternites slightly prolonged at sides. Texas and Arkansas..................*elata*

— Smaller (9 to 18.5 mm.); front of head normally with a median longitudinal carina and a small, smooth callus above the base of each antenna; hind margins of second, third, and fourth abdominal sternites more or less truncate. Pacific coast states.............................*californica*

8. Front of head with a median longitudinal carina; occiput with a small, smooth median area; apices of elytra usually with conspicuous spines; under surface blue black or bronze black..........................9

— Front of head without a median longitudinal carina, at most a smooth callosity at vertex; occiput densely and roughly punctured; apices of elytra normally with short indistinct spines; under surface black............10

9. Rather elongate, length of elytra more than four times longer than length of pronotum; apical elytral spines normally extending beyond sutural spines; fourth tarsal segment with a broad membranous lobe beneath; under surface bronze black.....................................*crypta*

— Rather robust, length of elytra less than four times longer than length of pronotum; elytra terminating in sutural spines; fourth tarsal segment with a narrow membranous lobe beneath; under surface blue black.....
....*tularensis*

10. Front of head usually concave; lateral margins of median lobe of male genitalia with five to eight rather inconspicuous lateral processes, pro-

duced somewhat posteriorly and flattened against the median lobe, their rims not attaining the midline. Southern coast ranges, California. . *cazieri*

— Front of head usually flattened; lateral margins of median lobe of male genitalia with seven to 11 prominent lateral processes, anterior-posteriorly flattened and extending out nearly at right angles, their rims extending nearly to midline of median lobe, those processes nearest the apex most conspicuous. Southern Sierra Nevada to the San Jacinto Mountains, California. . . . . *cyanea*

Polycesta arizonica Schaeffer

Polycesta arizonica SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 21. FALL, 1906, Ent. News, vol. 17, p. 166. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 230; 1933, Jour. New York Ent. Soc., vol. 41, p. 39.

MALE: Slender, medium sized, rather feebly shining, black with a reddish green luster.

Head with front convex, with a slight depression above clypeus, with or without a median carina, densely, irregularly, and rather finely punctured, rather densely clothed with short, suberect, silvery hairs; occiput with a smooth median area, more sparsely punctured than front, nearly glabrous; antennae slender, black, rather sparsely clothed with short, fine, pale hairs, segments longer than broad, finely, inconspicuously reticulate; clypeus very broadly and shallowly, triangularly emarginate in front, front angles narrowly rounded.

Pronotum transverse, approximately twice as broad as long, front narrower than base, widest at basal third; front margin feebly emarginate with a broad lobe at middle, a row of fine, silvery hairs extending from under front margin nearly to eyes on either side of middle; sides rather feebly, arcuately rounded; hind angles acute, hidden under front margin of elytra; basal margin broadly bisinuate; surface with disk flattened, slightly depressed at middle near base, densely, rather finely punctured, reticulate, except for a smooth, narrow median line extending from base to front margin which bears a finely impressed line basally, rather densely clothed with fine, short, silvery hairs along sides.

Scutellum nearly square, flattened or impressed, nearly smooth, glabrous.

Elytra as wide as pronotum, slightly more than four times longer than length of pronotum; humeri obsolete, humeral angles obtusely angulate; sides very feebly sinuate to behind middle, then gradually, somewhat arcuately tapering to apices; lateral margins coarsely and irregularly spinose slightly before and at apices;

sutural margins divergent before apices, expanded at apices; scutellar costae distinct; striae consisting of rows of moderate-sized, irregular punctures, separated from each other by nearly their own widths; second and fourth interstrial spaces costate, entire, sinuate, sparsely punctured with small, round punctures along sides of costae; sixth interstrial spaces sparsely and irregularly punctured with small, round punctures, feebly costate at middle, somewhat sinuate; surface sparsely clothed with very short, erect, silvery hairs along lateral margins.

Under surface with thoracic sternites finely, densely punctured along sides, median areas smooth except for a few small punctures, pubescence rather dense, mainly confined to the sides, consisting of rather short, semirecumbent, silvery hairs, front margin of prosternum strongly bisinuate; abdominal sternites finely, densely punctured along sides, sparsely punctured at middle, impunctate along hind margins, pubescence as on thoracic sternites, hind margin of first abdominal sternite truncate, more or less obsolete at middle, hind margin of second abdominal sternite broadly lobed at middle, semicircularly emarginate near sides, acutely prolonged at sides, hind margins of third and fourth abdominal sternites broadly and feebly rounded posteriorly, prolonged at the sides, last abdominal sternite very broadly triangular, hind margin arcuate, narrowly prolonged at apex, disk rather finely and densely punctured. Third and forth tarsal segments with a broad membranous lobe beneath.

Length: 11.5 mm. to 16.3 mm.

FEMALE: Differs from the male by having the hind margins of the first four abdominal sternites feebly lobed at middle, slightly prolonged at the sides; last abdominal sternite triangularly prolonged, side margins straight, oblique, hind margin truncate, feebly notched at middle, disk with a narrowly raised median line near apex.

Length: 18 mm. to 23.3 mm.

TYPE LOCALITY: Palmerlee, Cochise County, Arizona.

RECORDED DISTRIBUTION: Arizona: Palmerlee, Cochise County; Catalina Mountains; Redington; Huachuca Mountains; Santa Rita Mountains.

MATERIAL EXAMINED: Arizona: Prescott, June 30 (D. J. and J. N. Knull); Santa Rita Mountains, July 26 (W. J. Chamberlin); Chochise County, July 20, 1908 (V. W. Owen); Chiricahua Mountains, August (D. K. Duncan); Huachuca Mountains,

July 10 to 16; Carr Canyon, Huachuca Mountains, June 6, 1930 (E. G. Linsley); Miller Canyon, Huachuca Mountains, July 7 and 10 (H. W. Wenzel). New Mexico: Silver City, August 1, 1933. Texas: Davis Mountains, July 6 (J. N. Knull); Chisos Mountains, July 16 (H. W. Wenzel); July 9, 1939, and July 17, 1946 (D. J. and J. N. Knull).

HOSTS: Reared and collected from *Quercus hypoleuca* and *Quercus* spp.

This species appears to occupy a rather large area in the southwestern United States, but it is restricted within this area to more or less isolated spots where its host plants may be found. Thus it is to be found in the mountainous regions of the Southwest where oaks occur. In contrast, *P. velasco*, a closely related species, occurs at the lower elevations in the southwestern United States and northern Mexico in the typical desert area. Fall (1906) records *P. arizonica* from Fort Yuma, California (which was located across the Colorado River from the present town of Yuma, Arizona). However, it is believed that this record was based on incorrectly determined or mislabeled material, for this locality is in the typical desert area far removed from areas where the known hosts of *P. arizonica* occur.

The only species with which *P. arizonica* could be confused is *P. velasco*. It may be readily separated, however, by being smaller and narrower, by having the alternate interstrial spaces of the elytra costate, by having the sutural margins of the elytra widened at the apices and by exhibiting a very distinctive reddish green luster.

There is a female specimen from the Huachuca Mountains, Arizona, in the Van Dyke collection which differs slightly from typical examples of *P. arizonica*. The last abdominal sternite of this specimen has a very prominent, median, longitudinal carina near the apex, the side margins are slightly arcuate, and the apex is very narrowly rounded without any indication of a notch.

Polycesta velasco Castelnau and Gory

Polycesta velasco CASTELNAU AND GORY, 1837, Histoire naturelle . . . des insectes coléoptères, buprestides, vol. 2, p. 5. LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia, (1858), vol. 10, p. 68; 1859, Trans. Amer. Phil. Soc., vol. 11, p. 221. CROTCH, 1873, Proc. Acad. Nat. Sci. Philadelphia, vol. 35, p. 89. WATERHOUSE, 1882, Biologia Centrali-Americana, Coleoptera, vol. 3, no. 1, p. 18. HORN, 1894, Proc. California Acad. Sci., ser. 2, vol. 4, p. 328. WICKHAM, 1895, Canadian Ent., vol. 27, p. 294 (misidentification); 1898, Bull. Lab. Nat. Hist.

Univ. Iowa, vol. 4, no. 3, p. 305. FALL, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 118. WATERHOUSE, 1904, Ann. Mag. Nat. Hist., ser. 7, vol. 14, p. 258. KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 496. FALL, 1905, Ent. News, vol. 16, p. 73; 1906, Ent. News, vol. 17, p. 166. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 23. KERREMANS, 1906, Monographie des buprestides, vol. 2, p. 612. FALL, 1910, Trans. Amer. Ent. Soc., vol. 36, no. 2, p. 138. BURKE, 1917, Jour. Econ. Ent., vol. 10, p. 329; 1917, Bull. U. S. Dept. Agr., no. 437, pl. 4, fig. 4. ESSIG, 1926, Insects of western North America, p. 395. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 232. THERY, 1927, Ann. Ent. Soc. France, vol. 96, p. 249. CHAMBERLIN, 1933, Jour. New York Ent. Soc., vol. 41, p. 38. MOORE, 1937, Occas. Papers San Diego Nat. Hist. Soc., no. 2, p. 50. VAN DYKE, 1942, Proc. California Acad. Sci., ser. 4, vol. 24, no. 3, p. 98.

MALE: Rather slender, large sized, shining, black.

Head with front feebly depressed, rather moderately and irregularly punctured, punctures of moderate size, rather densely clothed with semirecumbent, silvery hairs; occiput with a smooth median area bearing a finely impressed line, more sparsely, finely, and uniformly punctured than front, nearly glabrous; antennae slender, black, moderately clothed with short, brownish hairs, segments longer than broad, finely, inconspicuously reticulate; clypeus very broadly and shallowly, arcuately emarginate in front, front angles broadly rounded.

Pronotum transverse, approximately twice as broad as long, front narrower than base; front margin feebly bisinuate, a row of fine silvery hairs extending from under front margin nearly to eyes on either side of middle; sides arcuate, somewhat expanded, widest at basal third; hind angles acute, concealed beneath front margin of elytra; basal margin broadly and strongly bisinuate; surface with disk flattened, slightly depressed at middle of base, rather sparsely punctured, punctures of moderate size, lateral areas more coarsely, densely punctured, reticulate, a narrow, smooth median area extending from base to middle, rather moderately clothed with fine, short, semirecumbent, silvery hairs near sides.

Scutellum nearly round, flattened, nearly smooth, glabrous.

Elytra slightly narrower than pronotum, four times longer than length of pronotum; humeri inconspicuous, humeral angles obtusely angulate; sides feebly sinuate to in front of apical third, then gradually rather arcuate to apices; lateral margins rather coarsely, irregularly spinose slightly before and at apices; sutural margins not expanded at apices; scutellar costae distinct; all

interstrial spaces costate, costae most conspicuous on those nearest suture, sides of costae bearing rows of fine punctures, striae consisting of moderate-sized, irregular, shallow punctures, most conspicuous near sides; surface sparsely clothed with very short, erect silvery hairs.

Under surface rather finely and moderately punctured, nearly impunctate on median areas, densely clothed with rather long, silvery, semirecumbent hairs along sides, sparsely pubescent on median areas; prosternum swollen in front of fore coxae, front margin bilobed; hind margin of first abdominal sternite broadly lobed at middle; hind margin of second abdominal sternite bisinuate, feebly prolonged at sides; hind margins of third and fourth abdominal sternites nearly truncate, feebly prolonged at sides; last abdominal sternite broadly triangular, narrowly prolonged at apex, side margins arcuately rounded, sides of prolongation nearly parallel, hind margin broadly rounded, basal two-thirds of prolongation with a strong median carina which is acute at apex. Third and fourth tarsal segments with a broad membranous lobe beneath.

Length: 15 mm. to 21 mm.

FEMALE: Differs from the male by having the hind margin of first abdominal sternite broadly but feebly lobed at middle; hind margins of second, third, and fourth abdominal sternites nearly truncate, slightly prolonged at sides; last abdominal sternite triangular, more or less elongate, lateral margins feebly arcuate, hind margin very broadly rounded, a transverse subapical carina slightly indicated in front of hind margin.

Length: 19.5 mm. to 27.5 mm.

TYPE LOCALITY: Mexico.

RECORDED DISTRIBUTION: Mexico: Lower California. California: Indio; San Diego County; Devil's Canyon, San Diego County. Arizona: Sabino Canyon; Catalina Mountains; Florence; Yuma; Tucson; Ft. Huachuca. New Mexico. Texas: Carmel; Hermit County; Laredo; Encinal.

MATERIAL EXAMINED: California: Newberry, Mojave River, San Bernardino County, June 28 (T. Craig); Indio, Riverside County, July 7, 1941 (D. J. and J. N. Knull); Coachella, Riverside County, July 26, 1941 (F. M. Beer); Thermal, Riverside County, June 17, 1940 (K. S. Hagen); Painted Canyon, Riverside County, June 21, 1941 (W. F. Barr, K. S. Hagen); Lost Palms Canyon, Riverside County, June 28, 1946 (W. F. Barr and J. W.

MacSwain); 23 miles south of Vidal, June 12, 1940 (W. F. Barr); 8 miles north of Blythe, June 26, 1946 (W. F. Barr); Blythe, July 22, 1947 (W. F. Barr); Ripley, Riverside County, June 25, 1946 (W. F. Barr). Nevada: Las Vegas, August 1 (J. N. Knull). Arizona: Ehrenberg, July 22, 1939 (F. H. Parker); July 26, 1946 (E. C. Van Dyke); Stoval, Yuma County, June 28, 1936 (M. A. Cazier, E. S. Ross); Yuma; San Luis, Yuma County, June 19, 1940 (W. F. Barr); Wickenburg, June 29, 1939 (D. J. and J. N. Knull); Florence, July 17 and 18, 1903 (C. R. Biederman); 14 miles east of Oracle, July 25, 1924 (E. P. Van Duzee); Sabino Canyon, July 23, 1933; Tucson, July, 1924 (Wickham); July 12, 1929 (R. W. Black); "Ariz." Texas: Marathon, June 10, 1930 (E. G. Linsley); Encinal, June 29, 1930 (J. O. Martin); Zapata County, June 2, 1939 (D. J. and J. N. Knull); Dimmit County (Leutgens); "Tex" (Fuchs).

HOSTS: The recorded hosts are *Prosopis juliflora glandulosa*, *Acacia greggii*, and *Cercidium floridum*. In addition to these, the writer has beaten this species from *Larrea divaricata* and *Dalea spinosa*, in which it may also breed.

Polycesta velasco is one of the typical buprestids found in the true desert regions of the great Southwest. It tends to be less punctured and more pubescent than other members of this genus. Undoubtedly these modifications are adaptions which help the insect to withstand the high temperatures with which it is associated. These modifications also help to serve as a ready means by which this species may be identified. *P. velasco* may be distinguished from all others by its large size and by having all of the elytra interstrial spaces costate; moreover, the ventral surface, especially towards the sides, is quite heavily clothed with long silvery hairs.

Several writers have indicated that this species may be synonymous with *P. montezumae* Castelnau and Gory, a species that is recorded from Mexico, Colombia, and Ecuador, but until specimens of the latter can be examined, this writer feels that *P. velasco* should be retained as a distinct species.

Polycesta abdita, new species

MALE: Rather slender, medium sized, feebly shining, black, elytra ferrugineous, costae dark, under surface more strongly shining with slight cupreous tinge, legs with purplish tinge.

Head with front slightly convex, without a median carina,

densely, rather coarsely and irregularly punctured, moderately clothed with rather long pale hairs; occiput finely, densely punctured, nearly glabrous; antennae slender, piceous, becoming ferrugineous towards apex, sparsely clothed with short, fine, brown hairs, segments longer than broad, finely reticulate; clypeus nearly truncate in front, front angles obtusely angulate.

Pronotum transverse, slightly less than twice as broad as long, front narrower than base, front margin bisinuate with median lobe rather well developed, a row of fine brownish hairs extending from under front margin nearly to eyes on either side of middle; sides obliquely expanded from front angles to basal third where they are obtusely rounded, then rather feebly narrowed to posterior angles which are obtusely angulate and more or less concealed beneath front margin of elytra; basal margin feebly bisinuate; surface with a broad median depression extending from base nearly to front margin, longitudinally carinate at middle and longitudinally impressed at base, an obsolete lateral depression in front of middle, punctures coarse, deep, and reticulate, rather sparse along margins of median depression, base nearly impunctate except for very fine reticulations, pubescence very sparsely placed, pale, short, and semirecumbent.

Scutellum rounded, broader behind, convex, impunctate, and glabrous.

Elytra as wide as pronotum, four times longer than length of pronotum; humeri obsolete, humeral angles broadly rounded; sides feebly sinuate to apical third, then arcuately converging to apices; lateral margins sparsely and irregularly spinose at apices; sutural margins slightly divergent before apices; scutellar costae distinct; striae consisting of rows of irregular punctures which are at about equal distance from one another; second and fourth interstrial spaces costate, entire, feebly sinuate; sixth interstrial spaces costate, obsolete at base and apex; surface glabrous.

Under surface rather densely, coarsely punctured, abdominal sternites less coarsely and deeply punctured, moderately clothed with short, silvery, suberect hairs; front margin of prosternum truncate; first abdominal sternite with a dense median patch of short yellowish hairs, less densely punctured at middle, an area behind hind coxa sparsely, rather coarsely scabrous, hind margin sinuate near side margins, broadly lobed at middle; hind margins of second, third, and fourth abdominal sternites more or less truncate; last abdominal sternite broadly triangular, side margins

feebly arcuate, apex broadly rounded. Third and fourth tarsal segments with a broad membranous lobe beneath.

Length: 16 mm.

FEMALE: Differs from the male by being slightly more robust, with a dense patch of hairs absent from the middle of the first abdominal sternite and with the last abdominal sternite more elongate and narrowly rounded at apex.

Length: 17 mm.

TYPE MATERIAL: Holotype, male (No. 59153, United States National Museum), from Chocoloskee, Florida. Allotype, female (the American Museum of Natural History), from Tortugas Island, Florida, July 1, 1925. One female paratype from Sunny Isles, Florida, June 13, 1935, in the collection of J. N. Knull, and one female paratype from Buck Key, Florida (G. Brainard), in the writer's collection. The writer has also seen a female specimen erroneously labeled "Ariz" which has not been designated as a paratype.

HOSTS: The only reference to a host is on the label of the allotype which was collected while flying around *Conocarpus* trees.

The paratypes are considerably larger than the allotype, each measuring approximately 22 mm. in length.

Polycesta abdita is very distinct from any of our species of *Polycesta*. The structure of the male genitalia, presence of a pubescent spot at the middle of the first abdominal sternite of the male, and the shape of the pronotum place it next to *P. angulosa*, which also occurs in Florida and with which it has been confused. However, it may be distinguished by having the elytra ferrugineous to piceous in color with distinct scutellar costae and at least four entire, longitudinal costae; also the elytra are not so coarsely and deeply punctured, and the pronotal depressions are more pronounced. *P. angulosa* has the elytra black with a cupreous tinge, the scutellar costae are usually faintly indicated, there is usually only a pair of distinct, longitudinal costae, and the striae consist of very coarse and deep and closely placed punctures.

Since the identity of these two species may have been confused in the past, several of the recorded localities of *P. angulosa* probably apply to *P. abdita* and thus should not be regarded as certain until additional collections can be made and the correct distributional status of the two ascertained. Data gathered from specimens show that *abdita* appears to be restricted to the Florida Keys, whereas *angulosa* occurs on both the mainland of Florida and the keys.

Polycesta angulosa Jacquelin Duval

Polycesta angulosa JACQUELIN DUVAL, 1857, *in* Ramon de la Sagra, Histoire physique, politique et naturelle de l'Île de Cuba, Animaux articulés (French edition), p. 62; 1857 (Spanish edition), vol. 7, p. 28. CHEVROLAT, 1867, Ann. Soc. Ent. France, ser. 4, vol. 7, p. 582 (separates, p. 158). GUNDLACH, 1891, Contribucion á la entomologia Cubana, vol. 3, no. 5, p. 166. KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 514. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 23. FALL, 1910, Trans. Amer. Ent. Soc., vol. 36, no. 2, p. 138. KNULL, 1922, Canadian Ent., vol. 54, p. 79. CHAMPLAIN AND KNULL, 1922, Canadian Ent., vol. 54, p. 102. FISHER, 1925, Proc. U. S. Natl. Mus., vol. 65, p. 20. KNULL, 1925, Ohio State Univ. Studies, vol. 2, no. 2, p. 5. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 230; 1933, Jour. New York Ent. Soc., vol. 41, p. 37.

Polycesta obtusa LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia (1858), vol. 10, p. 68; 1859, Trans. Amer. Phil. Soc., vol. 11, p. 220. CROTCH, 1873, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 89. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 23. FALL, 1910, Trans. Amer. Ent. Soc., vol. 36, no. 2, p. 138. CHAMBERLIN, 1933, Jour. New York Ent. Soc., vol. 41, p. 38.

Polycesta excavata, KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 513 (in part). FISHER, 1925, Proc. U. S. Natl. Mus., vol. 65, p. 22.

MALE: Moderately robust, medium sized, rather feebly shining, black with aeneous luster, more noticeable on under surface, elytra with cupreous tinge.

Head with front flat, without a median carina, densely, irregularly, rather coarsely punctured, moderately clothed with rather short, suberect, pale hairs; occiput without a smooth median area, more densely and finely punctured than front, nearly glabrous; antennae rather slender, black with purplish tinge, sparsely clothed with short, fine, pale hairs, segments longer than broad, finely, inconspicuously reticulate; clypeus very broadly and shallowly emarginate in front, front angles very broadly rounded.

Pronotum transverse, nearly twice as broad as long, front narrower than base; front margin feebly bisinuate, median lobe nearly obsolete, a row of brownish hairs extending from under front margin nearly to eyes on either side of middle; sides obliquely expanded from front angles to slightly behind middle where they are obtusely rounded, then rather feebly narrowed to near the posterior angles where they are nearly parallel; hind angles obtuse, hidden beneath the elytra; basal margin broadly bisinuate; surface with a broad, rather inconspicuous, median depression extending from base to in front of middle, and bearing a smooth median longitudinal line, a small, shallow inconspicuous lateral depression just in front of middle, punctures coarse, dense,

and deep, denser on anterior half where they are irregularly reticulate, sparsely clothed with a few short, inconspicuous hairs.

Scutellum subquadrate, slightly convex, nearly smooth, glabrous.

Elytra slightly wider than pronotum, four times longer than pronotum; humeri feebly evident, humeral angles obtusely angulate; sides very feebly sinuate to behind middle, then arcuately converging to apices; lateral margins coarsely and irregularly spinose slightly before and at apices; sutural margins slightly divergent before apices; scutellar costae feebly indicated; striae consisting of rows of very coarse and deep punctures, variable in size and shape, very closely placed to one another; interstrial spaces narrow, not raised except the second which are slightly costate and feebly sinuate and the fourth which are costate at the base of the elytra; surface glabrous.

Under surface rather densely punctured with moderate-sized punctures, more densely and coarsely punctured on thoracic segments, rather densely clothed with short, semirecumbent, pale hairs; front margin of prosternum feebly bilobed; first abdominal sternite with a dense median patch of short yellowish hairs, less densely punctured at middle, an area behind hind coxa sparsely, rather coarsely scabrous, hind margin sinuate near sides, broadly, arcuately lobed at middle; hind margins of second, third, and fourth abdominal sternites nearly truncate, feebly prolonged at sides; last abdominal sternite broadly triangular, sides arcuately rounded, rather broadly rounded at apex. Third and fourth tarsal segments with a broad membranous lobe beneath.

Length: 11.3 mm. to 15 mm.

FEMALE: Differs from the male by not having a dense patch of hairs at the middle of the first abdominal sternite and by having the last abdominal sternite more elongate, with the apex more narrowly rounded.

Length: 18 mm. to 23 mm.

TYPE LOCALITIES: Of *angulosa*, Cuba; of *obtusa*, "Philadelphia"; of *excavata*, Argentina.

RECORDED DISTRIBUTION: Cuba. Florida: Miami; Metacomba Key; Elliott Key; Key Largo; Buck Key. Alabama.

MATERIAL EXAMINED: Florida: Miami, April 12 and 25, 1921 (J. N. Knull); July 24, 1934 (F. N. Young); Metacomba Key; Long Key, May 15, 1939 (D. J. and J. N. Knull).

HOSTS: This species is recorded as breeding in *Coccolobis laurifolia*.

As pointed out by Chamberlin (1933) the type locality "Philadelphia" of the synonym *P. obtusa* was undoubtedly based on erroneously labeled material or due to the emergence of specimens from wood that had been brought from the south. The Alabama records are still questionable.

Polycesta angulosa may be immediately distinguished from any of the United States species of this genus by usually possessing only two entire, longitudinal costae on the elytra, by the presence of very deep and coarse, irregular elytral punctures which are somewhat reticulate, and by its distinct brassy luster.

Polycesta elata LeConte

Polycesta elata LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia (1858), vol. 10, p. 68; 1859, Trans. Amer. Phil. Soc., vol. 11, p. 220. CROTCH, 1873, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 89. KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 508. FALL, 1905, Ent. News, vol. 16, p. 73; 1906, Ent. News, vol. 17, p. 166. KERREMANS, 1906, Monographie des buprestides, vol. 2, p. 612. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 23. BURKE, 1917, Jour. Econ. Ent., vol. 10, p. 329. ESSIG, 1926, Insects of western North America, p. 395. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 231; 1933, Jour. New York Ent. Soc., vol. 41, p. 40.

Polycesta cavata LECONTE, 1859, Proc. Acad. Nat. Sci. Philadelphia (1858), vol. 10, p. 68; 1859, Trans. Amer. Phil. Soc., vol. 11, p. 220. CROTCH, 1873, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 89.

MALE: Rather slender, large sized, shining, bronze black. Head with front rather coarsely and irregularly punctured, rather sparsely clothed with short, suberect, pale hairs, concave, with an inverted Y-shaped carina which may be somewhat obliterated, extending nearly to the antennal bases; occiput more finely and sparsely punctured, glabrous, bearing a finely impressed, median line; antennae rather slender, shining, sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus shallowly emarginate in front, front angles very broadly rounded.

Pronotum transverse, nearly twice as broad as long, front narrower than base, widest at basal third: front margin slightly bisinuate, a row of pale brownish hairs extending from under front margin nearly to eyes on either side of middle; lateral margins obliquely, rather feebly expanded to basal third where they are broadly rounded and then rather sinuately narrowing to hind

angles which are nearly parallel and rather inconspicuous, tips rounded, concealed beneath front margin of elytra; basal margin rather feebly bisinuate; surface with a broad, median depression extending from base to front margin, on either side of median depression is a small, narrow depression extending from base to slightly beyond middle, median depression with a narrow, smooth carina at bottom, extending from near base to in front of middle, surface irregularly, densely, and rather coarsely punctured, areas between depressions and in front of lateral depressions smooth except for a few fine hairs along lateral margins.

Scutellum elongate oval, convex, nearly smooth, shining and glabrous.

Elytra wider than pronotum, four times longer than length of pronotum; humeri nearly obsolete, humeral angles obtusely angulate; sides slightly expanded behind base, nearly parallel to apical third, then gradually, somewhat arcuately tapering to apices; margins before and at apices irregularly and sparsely spinose, apices feebly divergent; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate, second and fourth costae entire, nearly straight, cristate and smooth, sixth costae obsolete basally and apically, feebly arcuate, cristate with a few lateral punctures, eighth costae obsolete at base, sinuate; remaining interstrial spaces not costate, bearing irregular rows of rather small, round punctures; striae consisting of large, irregular punctures, somewhat reticulate; surface nearly glabrous.

Under surface with thoracic sternites rather finely, densely punctured along sides, sparsely punctured at middle, rather sparsely clothed with short, pale, semirecumbent hairs; prosternum feebly bisinuate in front; disk of first abdominal sternite swollen, hind margin broadly lobed at middle, slightly prolonged at sides; hind margin of second abdominal sternite slightly arcuate posteriorly, slightly prolonged at sides; hind margins of third and fourth abdominal sternites truncate, prolonged at sides; last abdominal sternite triangular, side margins broadly arcuate, distinctly prolonged at apex, hind margin nearly truncate, hind angles obtusely rounded. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 15.2 mm. to 18 mm.

FEMALE: Differs from the male by having the disk of the first abdominal sternite flattened and the last abdominal sternite triangular and feebly prolonged at apex with the side margins very slightly sinuate and the hind margin broadly rounded.

Length: 20.5 mm. to 26.8 mm.

TYPE LOCALITIES: Of *elata*, Texas; of *cavata*, Alabama.

RECORDED DISTRIBUTION: Texas: Burnett County; Colorado County; Fedor, Lee County; Alpine; Cypress Mills; El Paso; Bethage.

MATERIAL EXAMINED: Texas: Llano County, June 11, 1941 (J. E. Gillaspy); Alpine, June; Austin, June 20, 1930 (E. G. Linsley); Burnett County; Cypress Mills, January 13, 1888; "Tex." Arkansas: Camp Robinson, June, 1943 (E. Hagen).

HOSTS: Chamberlin lists the following trees as the recorded hosts of *P. elata: Quercus obtusifolia, Q. arizonica, Q. emoryi, Q. hypoleuca, Plantanus wrightii, Celtis reticulata*, and *Prosopis juliflora*.

The "Arizona" and "California" records for this species are incorrect, as must be several of the recorded hosts. The type locality "Alabama" for the synonym *P. cavata* was probably based on a mislabeled specimen and thus may also be incorrect.

Polycesta elata is one of the largest and better known species of *Polycesta* occurring in the United States, yet it is represented by rather small series in most collections. The general form and bronze color immediately associate it with *P. californica*, to which it is closely related. However, the size, distribution, and structure of the male genitalia of these species are quite distinct. *Elata*, known only from Texas and Arkansas, is the larger, ranging from approximately 15 mm. to 27 mm. in length. *Californica*, which occurs in the Pacific coast states, exhibits a size variation of from 10.5 mm. to 20 mm. The genitalic differences may be best seen on examination of figure 8. *P. elata* may be further distinguished by the presence of an inverted Y-shaped median carina on the front of the head and by having the hind margins of the abdominal sternites slightly prolonged at the sides.

Polycesta californica LeConte

Polycesta californica LECONTE, 1857, Reports of explorations and surveys to ascertain . . . route for a railroad from Mississippi River to Pacific Ocean, 47th parallel, Insects, Coleoptera, vol. 12, p. 45; 1859, Proc. Acad. Nat. Sci. Philadelphia (1858), vol. 10, p. 68; 1859, Trans. Amer. Phil. Soc., vol. 11, p. 220. CROTCH, 1873, Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 89. FALL, 1901, Occas. Papers California Acad. Sci., vol. 8, p. 118. KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 508. FALL, 1905, Ent. News, vol. 16, p. 73; 1906, Ent. News, vol. 17, p. 166. SCHAEFFER, 1906, Canadian Ent., vol. 38, p. 22. KERREMANS, 1906, Monographie des buprestides, vol. 2, p. 612. BURKE,

1917, Jour. Econ. Ent., vol. 10, p. 329. CHAMBERLIN, 1917, Ent. News, vol. 28, p. 166. GOOD, 1925, Ann. Amer. Ent. Soc., vol. 18, pl. 10. ESSIG, 1926, Insects of western North America, p. 395. CHAMBERLIN, 1926, Catalogue of the Buprestidae of North America, p. 320; 1933, Jour. New York Ent. Soc., vol. 41, p. 42. MOORE, 1937, Occas. Papers San Diego Soc. Nat. Hist., no. 2, p. 50. BEER, 1940, Pan-Pacific Ent., vol. 16, no. 1, p. 13. BEER AND HATCH, 1941, Univ. Washington Publ. Biol., vol. 10, no. 3, p. 101. WHITE, 1942, Bull. Brooklyn Ent. Soc., vol. 37, no. 1, p. 34.

Polycesta cribrana MOTSCHULSKY, 1859, Bull. Soc. Imp. Nat. Moscou, vol. 32, no. 2, p. 182. WATERHOUSE, 1889, Biologia Centrali-Americana, Coleoptera, vol. 3, no. 1, p. 177. KERREMANS, 1904, Monographie des buprestides, vol. 1, p. 485.

Polycesta californica bernardensis OBENBERGER, 1924, Arch. Naturgesch., sect. A., vol. 90, no. 3, p. 35. CHAMBERLIN, 1933, Jour. New York Ent. Soc., vol. 41, p. 42.

MALE: Slender, medium sized, feebly shining, dark bronze, elytra inconspicuously mottled with dark splotches, under surface bronze and distinctly shining.

Head rather coarsely and densely punctured on front, punctures varying in size and shape, rather finely, densely punctured behind eyes and on occiput; front flattened with a smooth, median carina extending from vertex nearly to clypeus and a smaller, smooth, irregular callosity above the base of each antenna, moderately clothed with fine, short, suberect, silvery hairs; occiput with a narrow, impunctate, median area bearing a finely impressed line at middle, more sparsely pubescent than front; antennae shining, rather slender, sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus with front margin broadly and very shallowly, triangularly emarginate, front angles obtusely rounded.

Pronotum transverse, approximately twice as broad as long, front narrower than base, widest behind middle; front margin nearly truncate, feebly lobed at middle, a row of fine brownish hairs extending from under front margin nearly to eyes on either side of middle; lateral margins obliquely expanded to behind middle where they are broadly rounded and then obliquely narrowing to hind angles which nearly form inconspicuous right angles; basal margin bisinuate; surface with a broad median depression extending from base nearly to front margin, on either side of median depression is a small, narrow depression slightly behind middle, median depression with a narrow, non-punctured area bearing a finely impressed line on basal half and a feeble carina on anterior half; surface rather uniformly, densely,

coarsely, and deeply punctured, reticulate, except for areas between depressions which are very sparsely punctured, nearly glabrous.

Scutellum oval, convex, nearly smooth and glabrous, shining.

Elytra slightly wider than pronotum, usually a little more than four times longer than length of pronotum; humeri inconspicuous, humeral angles obtusely angulate; sides slightly expanded behind base, very feebly sinuate nearly to apical third, then gradually, somewhat arcuately tapering to apices; margins before and at apices irregularly spinose, apices slightly divergent; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate, second and fourth costae entire, nearly straight, cristate and smooth, sixth costae obsolete basally and apically, feebly arcuate, cristate with a few lateral punctures, eighth costae nearly entire, feebly bisinuate, punctured basally, smooth apically; remaining interstrial spaces not costate, bearing irregular rows of moderate-sized, elongate punctures; striae consisting of deep, coarse punctures; surface glabrous except for a few very fine, short, silvery hairs along lateral margins and at apex.

Under surface densely, rather finely, shallowly punctured except for median smooth areas, moderately clothed with short, suberect, brownish hairs; front margin of prosternum shallowly emarginate; disk of first abdominal sternite swollen, hind margin broadly lobed at middle; hind margin of second abdominal sternite feebly arcuate posteriorly, not prolonged at the sides; hind margins of third and fourth abdominal sternites very feebly arcuate anteriorly, not prolonged at the sides; last abdominal sternite broadly triangular, lateral margins arcuate, apex somewhat prolonged, bearing a faintly indicated median ridge, hind margin rather narrowly rounded, shallowly notched at middle. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 10.5 mm. to 16.8 mm.

FEMALE: Differs from the male by having the first abdominal sternite flattened at the middle; the triangular last abdominal sternite is more elongate with the side margins very feebly arcuate and the hind margin nearly semicircularly rounded with or without a feeble notch at the middle; there is also a trace of a subapical carina on the disk.

Length: 12.5 mm. to 20.2 mm.

TYPE LOCALITIES: Of *californica*, Sacramento, California; of *cribrana*, "in the north of Mexico"; of *bernardensis*, San Bernardino, California.

Recorded Distribution: Washington: Seattle. Oregon: Gold Hill; Ashland. California: Yreka; Trinity County; Sacramento; Placerville; Yosemite; Los Gatos; North Fork; Sequoia National Park; Sunset Valley, Santa Barbara County; Mt. Wilson; Los Angeles; Pasadena; San Diego; Laguna. Lower California.

Material Examined: Washington: Yakima Park, Mt. Rainier, July 8, 1938 (A. W. McLain). Oregon: Crabtree, July 30, 1940 (F. M. Beer); Merlin, March 17 and June 17, 1941 (F. M. Beer); Grants Pass, September 24, 1940 (F. M. Beer); Rogue River, March 19, 1939 (F. M. Beer); Murphy, December 30, 1940 (F. M. Beer); Ashland, May 15 and 18, 1938 (F. M. Beer). California: Carrville, Trinity County, June 16 and 25, 1913, and June 26, 1931; Shingletown, Shasta County, June 3, 1941 (P. D. Hurd, Jr.); Oroville, May 30, 1928 (H. H. Keifer); Yuba City, Sutter County, June 22, 1933; Auburn, June, 1933 (C. R. Clar); Rocklin, July 1, 1927; Davis, May 20, 1936 (B. E. White); Marsh Creek Springs, Contra Costa County, May 9, 1937 (E. C. Van Dyke); Russelman Park, east slope of Mt. Diablo, Contra Costa County, May 21, 1931 (E. C. Van Dyke); Livermore, August, 1903; Livermore Canyon, Alameda County, October 22, 1927; Manteca, San Jaoquin County, October 7, 1938 (K. S. Hagen); Sonora, Tuolomne County, July 5, 1936; Jamestown, Tuolomne County, June 11, 1931; Smith's Creek, Santa Clara County, 2000 feet, July 4, 1909; Mariposa County, June 6, 1914 (F. W. Nunenmacher); Yosemite National Park, June 15, 18, and 30, 1921; Oakhurst, Madera County, May 26, 1942 (A. J. Walz); Santa Cruz Mountains; Tassajara, Monterey County, May 27, 1920 (L. S. Slevin); Auberry, Italian Creek, Fresno County, May 22, 1932; Tulare County; Sequoia National Park, May 19 to June 20, 1929; Kaweah, Tulare County, July 4 (F. T. Scott, R. S. Wagner); Wolverton, Sequoia National Park, June 2, 1929; Paradise Valley, Sequoia National Park, June 18, 1929; Potwisha, Sequoia National Park, May 18 to June 13, 1929; July 1, 1941 (E. C. Van Dyke); Springville, Tulare County, July 1, 1933 (F. T. Scott); California Hot Springs, Tulare County, June 3 to 5, 1939; Fairview, Tulare County, July 3, 1939 (D. L. Dow); Caliente Creek, Kern County (F. Grinnell); Woody, Kern County, June 4, 1938; Greenhorn Mountains, Kern County, May 26, 1946 (B. E. White); Kernville, Kern County, June 16, 1947 (V. S. and F. M. Beer); Havilah, Kern County, May 16,

1930; Sunset Valley, Santa Barbara County, July 4, 1939 (W. F. Barr, E. C. Van Dyke); Los Angeles County; Mt. Wilson, Los Angeles County, June 28, 1918; San Bernardino County; Lake Arrowhead, June 29, 1940; Mill Creek, San Bernardino County, December 29, 1940 (J. R. Fisher); Lytle Creek, San Bernardino County, June 8, 1928 (E. C. Van Dyke); Forest Home, San Bernardino County, June 15, 1928 (E. C. Van Dyke); Highland, San Bernardino County; Idyllwild, San Jacinto Mountains, July 28, 1928 (E. C. Van Dyke); June 20, 1940 (K. S. Hagen); June 13 to 22, 1941 (E. C. Van Dyke); Pine Cove, San Jacinto Mountains, June 3, 1939 (B. Brookman); Herkey Creek, San Jacinto Mountains, May 27, 1941 (D. J. and J. N. Knull); June 21, 1941 (E. C. Van Dyke); Santa Rosa Mountain, Riverside County, May 27 and June 5, 1946 (D. J. and J. N. Knull).

RECORDED HOSTS: *Quercus kelloggii*, *Q. chrysolepis*, *Q. douglasii*, *Q. garryana*, *Q. californica*, *Q. wislizeni*, *Arbutus menziesii*, *Populus fremontei*, *Alnus rhombifolia*, *Cercocarpus parvifolius*, *Pyrus malus*, *Acer macrophyllum*, *Heteromeles arbutiviscida*, *Acacia greggii*, and *Salix* sp. In addition, labels on several specimens indicate that *P. californica* has been beaten or swept from *Ceanothus cuneatus*, *Cercocarpus betuloides*, and *Eriodictyon* sp. These plants may also prove to be hosts of this buprestid.

Chamberlin (1933) placed Obenberger's subspecies *bernardensis* as a synonym of *P. californica*, and the present author is in agreement with this. *P. californica* is a very variable species and judging from Obenberger's description no valid characters are offered that justify a subspecific status for *bernardensis*. Since this synonomy is apparently based solely on the description and since this description may not be available to all, it is included below.

"*Polycesta californica* ssp. *bernardensis* m. n. ssp. Hab. Californien: San Bernardino. Long 12 mm. Lat. 4 mm. Kleiner, länglicher als die typische Form. Die Flügeldeckenrippen sind niedriger, Flügeldecken sind kürzer zugespitzt, Halsschild ist weniger breit, seitlich etwa in der Mitte am breitesten, regelmässig verrundet, in der Mitte und seitlich kaum eingedrück. Kopf ohne die drie, für typische Form charakteristischen Reliefchen."

As pointed out by Chamberlin, Essig's record of *P. californica* occurring in Alaska must be erroneous. The writer believes that this error was due to the fact that *P. cavata* was placed as a

synonym of *P. californica* in the 1920 Leng "Catalogue of the Coleoptera" and that the distribution of *cavata* was listed as "Ala," meaning Alabama. Apparently Essig, knowing *californica* to be a west coast species, interpreted this abbreviation of Alabama to mean Alaska and thus recorded *californica* as occurring in this northern territory.

Although there are now two records of the occurrence of this species in the state of Washington, they must be regarded with considerable doubt. Beer and Hatch have pointed out that the "Seattle" record is undoubtedly due to mislabeling of specimens, and the present "Yakima Park" record appears also to be based on the same mistake. Yakima Park is located at an elevation of at least 6000 feet in Rainier National Park, and none of the known host plants of *P. californica* would be found there. Thus it is assumed that this species does not occur at this locality. However, it may occur at lower elevations in southern Washington, west of the Cascade Mountains. Additional collections are certainly needed in order to verify its occurrence in this state.

The Texas records for *P. californica* are definitely incorrect. These records were probably taken from misidentified specimens of *P. elata*. *P. californica* is also recorded as occurring in Lower California. Its range may extend into this region, but it is rather doubtful. At present the southernmost known locality for *californica* is some 65 miles from the Mexican border. The San Diego and Laguna records refer to *P. cazieri*.

Polycesta californica is the most numerous and variable of the United States *Polycesta*. Coupled with this abundance and variability are the large number of plant species in which it breeds and the rather wide range it occupies. It is most abundant in California, occurring only on the west side of the Sierra Nevada Mountains, especially in the foothill regions of this and the Coast Ranges where its host plants are most abundant. In Oregon it is found only on the west side of the Cascade Mountains.

On the basis of the external structure and color as well as the characters of the genitalia, *P. californica* is placed between *P. elata* and *P. hageni*, being more closely related to the latter. From *elata* it may be distinguished by the radical differences in the male genitalia, the more densely punctured pronotum, by having a longitudinal carina on the front of the head with or without a smooth callosity above the base of each antenna, and by having

the hind margins of the abdominal sternites not noticeably prolonged at the sides. From *hageni* it is most easily distinguished by having the antennal segments longer than broad. There are differences also in the structure of the male genitalia.

Polycesta hageni, new species

MALE: Rather slender, rather small sized, very feebly shining, blackish bronze, under surface more shining and bronze.

Head densely, rather irregularly punctured, reticulate, sparsely clothed with short, fine hairs; front flattened with a short median carina near vertex; occiput and vertex with an impressed, fine, median line; antennae rather dull, short, sparsely clothed with short, stiff, brownish hairs, finely densely punctured, reticulate, segments four to seven broader than long; clypeus very broadly and shallowly emarginate in front, front angles broadly rounded.

Pronotum transverse, less than twice as broad as long, front narrower than base, widest behind middle; front margin nearly truncate, broadly but feebly lobed at middle, a row of fine, tannish hairs extending from under front margin to eyes on either side of middle; lateral margins obliquely expanded to behind middle, where they are broadly rounded, and then obliquely and rather sinuately narrowing to inconspicuous hind angles which are acute and hidden beneath the front margin of elytra; basal margin bisinuate; surface with a rather broad median depression extending from base to front margin, deeply impressed at base, on either side of median depression is a small lateral depression slightly behind middle; surface rather densely and coarsely punctured, reticulate except for areas between depressions which are nearly smooth except for a few deep, round punctures, pubescence consisting of a very few fine, short, silvery hairs along lateral margins.

Scutellum oval, raised, and convex, very finely and densely punctured, reticulate, glabrous.

Elytra slightly wider than pronotum, slightly less than four times longer than length of pronotum; humeri inconspicuous, humeral angles obtusely rounded; sides obliquely and feebly expanded behind base, feebly sinuate to in front of apical third, then arcuately converging to apices; margins sparsely and irregularly spinose slightly before and at apices, sutural margins feebly divergent at apices; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate, second and fourth

costae entire, nearly straight, cristate and smooth, sixth costae obsolete except just in front of middle, eighth costae nearly entire, sinuate, punctured; remaining interstrial spaces bearing rows of moderate-sized, round punctures; striae consisting of rows of very deep, coarse, elongate punctures; surface glabrous.

Under surface very densely, rather finely, shallowly punctured, median areas sparsely punctured, rather moderately clothed with short, semirecumbent, pale hairs; front margin of prosternum very feebly emarginate, nearly truncate; disk of first abdominal sternite swollen, hind margin broadly, rather shallowly lobed; hind margin of second abdominal sternite feebly arcuate posteriorly, not prolonged at the sides; hind margins of third and fourth abdominal sternites truncate, not prolonged at the sides; last abdominal sternite broadly triangular, lateral margins feebly sinuate, apex very slightly prolonged, hind margin rather narrowly rounded, shallowly notched at middle. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 11 mm.

FEMALE: Differs from the male by being more robust, larger in size, by having the disk of the first abdominal sternite feebly swollen, the hind margin of the second abdominal sternite truncate, and by having the last abdominal sternite triangular with the lateral margins slightly arcuate and the hind margin rather narrowly rounded.

Length: 12.9 mm.

TYPE MATERIAL: Holotype, male, and allotype, female, from Kernville, Kern County, California, June 7, 1940. Holotype collected by the writer and remaining in his collection. Allotype collected by K. S. Hagen and deposited in the California Academy of Sciences (Ent., No. 5930). Three male and two female paratypes from Kernville, California, June 7, 1940 (Barr, Hagen); one female paratype from Lone Pine, Inyo County, California, May 29, 1937 (E. C. Van Dyke); and two male and two female paratypes from Independence, Inyo County, California, June 14, 1937 (N. W. Frazier, J. H. Mitchell). Paratypes in the collections of the American Museum of Natural History, K. S. Hagen, E. C. Van Dyke, B. E. White, University of California, and the writer.

For his help during the course of this study, the writer takes pleasure in naming this species in honor of his friend Kenneth S. Hagen.

HOSTS: All the specimens collected at the type locality were swept from *Chrysothamnus* sp. (rabbit-brush), which is the probable host of this species.

Polycesta hageni is most likely to be confused with the variable *P. californica* with which it is most closely related. However, the antennal structure of these species offers a ready means of separation. The antennae of *hageni* are short, with the segments deeply reticulate, dull, and clothed with short coarse hairs; segments four to seven are broader than long. The antennae of *californica* are rather long and slender, with the segments shallowly reticulate, shining, and clothed with longer and finer hairs; segments four to seven are distinctly longer than broad. *P. hageni* may be further distinguished by being more densely punctured throughout, by having the spines near the elytral apices much less pronounced and by being smaller in size. The males range from 10.8 mm. to 12.8 mm. and the females from 10.7 mm. to 12.9 mm. in length.

Polycesta crypta, new species

MALE: Rather slender, medium sized, feebly shining, black, front of head and under surface with a distinct bronze luster.

Head rather coarsely and densely, irregularly punctured on front, rather finely, densely punctured behind eyes and on occiput; front flattened with an irregular, smooth, median carina extending from vertex to area between antennal bases, moderately clothed with erect, fine, silvery hairs; occiput with a fine, impressed median line; antennae shining, moderately slender, rather sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus rather broadly, triangularly emarginate at middle, front angles rounded.

Pronotum transverse, more than twice as broad as long, front distinctly narrower than base, widest slightly behind middle; front margin bisinuate, a row of fine, silvery hairs extending from under front margin nearly to eyes on either side of middle; lateral margins obliquely expanded to middle where they are very broadly rounded and then obliquely and rather sinuately narrowed to hind angles; hind angles not prominent, somewhat concealed beneath base of elytra; basal margin bisinuate; surface with a broad median depression extending from base to in front of middle, on either side of median depression is a narrow lateral depression extending from base to middle, median depression with a narrow, non-punctured area extending from base to middle

and bearing a faintly indicated impressed line, surface rather uniformly, densely, coarsely, and deeply punctured, reticulate except for areas between median and lateral depressions which are more sparsely punctured, sparsely clothed with fine, silvery, semi-recumbent hairs.

Scutellum rather oval, convex, nearly smooth, shining, and glabrous.

Elytra slightly wider than pronotum, slightly more than four times longer than length of pronotum; humeri inconspicuous, humeral angles obtusely rounded; side slightly expanded behind base, sinuate to apical third, and then broadly, arcuately convergent to apices; margins irregularly spinose before and at apices, apices divergent; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate, second costa of each elytron entire, nearly straight, cristate, and smooth; fourth costa feebly sinuate, entire, cristate, and smooth except at base where it is somewhat flattened and punctured; sixth costa obsolete except at middle where it is slightly elevated and punctate; eighth costa rather conspicuously elevated and punctate, obsolete at basal fourth; remaining interstrial spaces not costate, bearing irregular rows of rather coarse round punctures; striae consisting of very deep and coarse punctures which are variable in size and shape and which form a rough reticulation between the costae; surface glabrous except for a few very fine, short, silvery hairs along lateral margins and at apex.

Under surface densely, rather coarsely, shallowly punctured except for median smooth areas, moderately clothed with short, fine, silvery hairs; front margin of prosternum nearly truncate; disk of first abdominal sternite feebly swollen, hind margin broadly lobed at middle; hind margins of second, third, and fourth abdominal sternites truncate; last abdominal sternite broadly triangular, lateral margins arcuate, apex shallowly and broadly notched, disk with a faintly indicated median ridge. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 12.6 mm.

Female: Differs from the male by being more robust, larger, by having the disk of the first abdominal sternite flattened, and by having the last abdominal sternite triangular and slightly prolonged with the lateral margins somewhat arcuate, the hind angles broadly rounded and the hind margin feebly bisinuate.

Length: 18.9 mm.

Type Material: Holotype, male (No. 5931, California Academy of Sciences, Entomology), and allotype, female (No. 5932, California Academy of Sciences, Entomology), and two female and three male paratypes from Idyllwild, San Jacinto Mountains, Riverside County, California, June 13 to 22, 1941, collected by E. C. Van Dyke. The holotype was collected on June 13 and the allotype on June 22. Additional paratypes as follows: one male from Sequoia National Park, California, altitude 5000 to 7000 feet, June 21, 1929 (A. T. McClay); one female from Sunset Valley, Santa Barbara County, California, July 2, 1939 (E. C. Van Dyke); one female from Kernville, Kern County, California, June 16, 1947 (V. S. and F. M. Beer); one female from Pinon Flat, San Jacinto Mountains, Riverside County, California, June 21, 1941 (E. C. Van Dyke); and one male from Santa Rosa Mountain, Riverside County, California, 7000 feet, June 15, 1946 (D. J. and J. N. Knull). Paratypes in the collection of F. M. Beer, J. N. Knull, E. C. Van Dyke, and the writer.

Hosts: No information is available concerning the host plants of this species.

The general form of *P. crypta* will immediately separate it from the other western species of *Polycesta*. The pronotum is distinctly more than twice as broad as long, and the elytra are slightly more than four times longer than the length of the pronotum. Thus the insect presents a rather unique appearance with its shortened and expanded pronotum and elongate elytra. In addition, the male genitalia exhibit characteristics that are quite distinct from those of the other species.

Polycesta tularensis Chamberlin

Polycesta cyaneous Chamberlin, 1933, Jour. New York Ent. Soc., vol. 41, p. 41 (in part).

Polycesta tularensis Chamberlin, 1938, Jour. New York Ent. Soc., vol. 46, p. 445.

Male: Rather robust, large sized, feebly shining; head, under surface, and legs distinctly blue black; pronotum and elytra more or less black.

Head coarsely and densely, rather irregularly punctured on front, rather finely, densely punctured behind eyes and on occiput; front concave with a smooth carina extending from vertex to area between the antennal bases, sparsely clothed with short, fine, pale hairs; occiput with a smooth median area containing

a fine, impressed, median line; antennae shining, slender, sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus nearly truncate in front, very shallowly and broadly arcuately emarginate.

Pronotum transverse, about twice as broad as long, front distinctly narrower than base, widest behind middle; front margin feebly emarginate with a very broad, inconspicuous lobe at middle, a row of yellowish hairs extending from under front margin nearly to eyes on either side of middle; lateral margins obliquely expanded to just behind middle where they are broadly rounded and then narrowing obliquely and somewhat sinuately to the nearly parallel hind angles which are acute and project slightly beneath the elytra; basal margin bisinuate; surface with a broad median depression extending from base nearly to front margin, bearing a smooth, impressed line at basal third, a small inconspicuous depression on either side slightly behind middle, the area between median and lateral depression nearly smooth except for a few scattered, round punctures, remainder of surface very densely and coarsely, irregularly punctured, pubescence consisting of a few scattered, fine, short, white hairs.

Scutellum pear shaped, longer than broad, flattened, finely sculptured, glabrous.

Elytra nearly as wide as pronotum, slightly less than four times the length of pronotum; humeri nearly obsolete, humeral angles obtusely rounded; sides expanded to basal eighth, very feebly sinuate to apical third, then obliquely converging to apices which terminate in acute sutural spines, apical margins coarsely and irregularly spinose; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate, second and fourth costae entire, nearly straight, cristate, and smooth, sixth and eighth costae feebly developed, obsolete at bases and apices, moderately punctured with rather coarse, round punctures; remaining interstrial spaces not costate, bearing irregular rows of rather coarse, round punctures; striae consisting of very deep and very coarse punctures, variable in size and shape, forming a rough, irregular network between the costae; surface glabrous.

Under surface densely, rather coarsely punctured except for median smooth areas, moderately clothed with short, fine, yellowish hairs; front margin of prosternum broadly lobed with lobe very feebly emarginate in front; disk of first abdominal sternite more or less flattened, hind margin broadly lobed at middle; hind

margins of second, third, and fourth abdominal sternites more or less truncate; last abdominal sternite broadly triangular, apex narrowly rounded, disk with a faintly indicated, smooth, median ridge. Fourth tarsal segment with a rather small, narrow membranous lobe beneath.

Length: 15 mm. to 20 mm.

FEMALE: Differs from the male by having the disk of the first abdominal sternite flattened at the middle and by having the last abdominal sternite slightly prolonged with the sides obliquely narrowing to an obtusely rounded apex.

Length: 16.1 mm. to 22 mm.

TYPE LOCALITIES: Of *tularensis*, Springville, Tulare County, California; of *cyaneous*, Sequoia National Park, California.

RECORDED DISTRIBUTION: California: Springville, Tulare County.

MATERIAL EXAMINED: California: San Antonio Valley Ranger Station, Mount Hamilton Range, Santa Clara County, June 20 and August 11, 1948 (R. van den Basch); Springville, Tulare County, August, 1933 (F. T. Scott); Kaweah, July, 1931 (F. T. Scott); Sequoia National Park, June, 1930 (F. T. Scott); Potwisha, July 1, 1941 (E. C. Van Dyke); Hammond, Sequoia National Park, June 18, 1947 (V. S. and F. M. Beer).

HOSTS: This species has been collected from the wood of *Quercus* sp.

Polycesta tularensis is readily recognized by its characteristic bluish black color and by the presence of a rather small, narrow, membranous lobe beneath the fourth tarsal segment. The front of the head is normally concave, with a median longitudinal carina extending the length of the depression. Each elytron terminates in a sutural spine which is also a significant characteristic of this species.

Since Buprestidae are rarely attracted to lights, it is of interest to note that the San Antonio Valley specimens were collected at a light trap.

Polycesta cazieri, new species

MALE: Robust, medium sized, feebly shining, black, front of head and lateral margins of pronotum with a faint bronze tinge.

Head rather coarsely and densely, rather irregularly punctured in front, rather finely, densely punctured behind eyes and on occiput; front flattened, median carina absent except for a small,

smooth callosity on vertex, moderately clothed with erect, fine, silvery hairs; occiput with a small, smooth median area containing a fine, impressed, median line; antennae shining, moderately slender, rather sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus broadly, very shallowly, triangularly emarginate in front.

Pronotum transverse, approximately twice as broad as long, front distinctly narrower than base, widest at basal third; front margin feebly emarginate with a very broad lobe at middle, a row of fine, silvery hairs extending from under front margin nearly to eyes on either side of middle; lateral margins arcuately rounded to basal third where they are broadly rounded and then obliquely extending to the inconspicuous hind angles which are concealed beneath the front margin of elytra; basal margin bisinuate; surface with a broad median depression extending from base nearly to middle, on either side of median depression is a small lateral depression slightly behind middle, area between median and lateral depression nearly smooth posteriorly except for a few scattered round punctures, more densely punctured towards front, remainder of surface very densely and coarsely, irregularly punctured, reticulate, pubescence consisting of a few scattered, fine, short, silvery hairs.

Scutellum bell shaped, longer than broad, convex, finely sculptured, glabrous.

Elytra at apical third nearly as wide as pronotum; humeri nearly obsolete, humeral angles slightly obtuse; sides feebly expanded at base, very slightly sinuate to apical third, then arcuately converging to apices, margins near apices finely, irregularly spinose; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate; second costae entire, nearly straight, cristate, and smooth; fourth costae feebly sinuate, entire, cristate, and smooth except at bases where they are broken by rather coarse round punctures; sixth and eighth costae feebly developed, obsolete at bases and apices, moderately punctate with rather coarse, round punctures; remaining interstrial spaces bearing irregular rows of rather coarse, round punctures; striae consisting of rows of very deep and very coarse punctures which are variable in size and shape, forming a rough, irregular network between the costae; surface with a few very fine, short, silvery hairs along lateral margins and at apex.

Under surface densely, rather coarsely punctured except for

median areas of thorax which are sparsely punctured, moderately clothed with short, fine, silvery hairs; front margin of prosternum very broadly lobed with lobe broadly and shallowly emarginate in front; first abdominal sternite feebly swollen along middle, hind margin broadly lobed at middle; hind margins of second, third, and fourth abdominal sternites more or less truncate; last abdominal sternite broadly triangular, lateral margins feebly arcuate, hind margin truncate, feebly notched, disk with a faintly indicated median ridge. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 14.8 mm.

FEMALE: First abdominal sternite flattened at middle; last abdominal sternite with apex broadly rounded and shallowly, arcuately emarginate at apex.

Length: 18.9 mm.

TYPE MATERIAL: Holotype, male (No. 5933, California Academy of Sciences, Entomology), and allotype, female, from Sunset Valley, Santa Barbara County, California. The holotype was collected on July 3, 1939, by E. C. Van Dyke and the allotype on July 4, 1939, by the writer. Allotype in the writer's collection. Paratypes from the following localities: One male and two females from Ojai, California, April 15, 1936 (W. E. Simonds); one male from Ojai, California, July 15, 1936 (Helen A. Brandt); one male from Etiwanda, California, May 30, 1927 (W. E. Simonds); one female from Upper Arroyo Seco, Los Angeles County, June 25, 1940; one male from Pasadena, California, June, 1922; one male from San Diego County, California, July 4, 1913 (E. P. Van Duzee); one female from Warner's Ranch, San Diego County, California, August 28, 1884 (F. E. Blaisdell); and one male from San Diego, California (F. E. Blaisdell). Paratypes in the collections of the California Academy of Sciences, the American Museum of Natural History, J. N. Knull, and the writer.

This species is named after Mont A. Cazier as a slight token of appreciation for his generous assistance and as an acknowledgment of the contributions he has made in his studies on North American Buprestidae.

HOSTS: The female specimen from Upper Arroyo Seco, Los Angeles County, California, was collected from *Chaenactis artemesiafolia*, a rather small composite native to southern California. It is assumed, however, that *P. cazieri* breeds in the wood of *Quercus* as do its allied species.

There are no external characters that may be used with certainty in distinguishing this species from *P. cyanea*. In general the males of *cazieri* have the middle of the first abdominal sternite swollen, while this area on the males of *cyanea* tends to be somewhat flattened. These species may be quickly separated, however, after an examination of the dissected male genitalia. With *cazieri*, the median lobe of the organ is not broadened and the lateral, plate-like structures are not prominent but obliquely flattened against the sides of the median lobe. With *cyanea* the median lobe is very broad with very conspicuous lateral plate-like structures extending out at nearly right angles. No morphological characters have been found by which the females may be separated.

At the present, there are definite differences in the distribution of these two species. *Cazieri* appears to be restricted to the southern Coast Range in California, occurring from the San Diego to the Santa Barbara areas, while *cyanea* has been collected in the inland mountain ranges from the San Jacinto area north to the Sequoia National Park region in the southern Sierra Nevada Mountains.

A few minor variations have been noted in the paratypic series. Some specimens may have the front of the head feebly concave; with others the smooth callosity on the vertex may be entirely lacking. In general the apex of the median lobe of the male genitalia appears to be less elongate, with the hind margin more narrowly rounded, in specimens from the San Diego region. A female specimen collected on *Ceanothus cuneatus* at the type locality by B. E. White is assigned to this species with some doubt, for it is quite atypical in structure and appearance. The general form is narrower, the lateral margins of the pronotum are not broadly expanded, there are prominent spines near the elytral apices, and the last abdominal sternite is rather narrowly rounded at the apex. Moreover, the specimen exhibits a distinct bronze luster with the areas between the pronotal depressions and the elytral costae black.

Polycesta cyanea Chamberlin

Polycesta cyaneous CHAMBERLIN, 1933, Jour. New York Ent. Soc., vol. 41, p. 41; 1938, Jour. New York Ent. Soc., vol. 46, p. 446.

MALE: Robust, rather small, very feebly shining, black. Head coarsely and densely, rather irregularly punctured on

front, rather finely, densely punctured behind eyes and on occiput; front very slightly concave, median carina absent except for a faintly indicated, small, smooth callosity on vertex, sparsely clothed with erect, fine, silvery hairs; occiput with a fine, impressed median line; antennae shining, moderately slender, sparsely clothed with short, fine, brownish hairs, segments longer than broad; clypeus truncate or broadly, very shallowly arcuately emarginate.

Pronotum nearly twice as broad as long, front somewhat narrower than base, widest slightly behind middle; front margin nearly truncate, a row of fine, tawny hairs extending from under front margin nearly to eyes on either side of middle; lateral margins broadly, arcuately rounded; hind angles inconspicuous, hidden beneath front margin of elytra; basal margin bisinuate; surface with a broad median depression extending from base to front margin, this depression bears a fine, impressed line from base nearly to middle, on either side of median depression is a small lateral depression slightly behind middle, area between median and lateral depression nearly smooth except for a few rather coarse, round punctures, a similar area, but very small, between lateral depression and hind angle, remainder of surface very densely and coarsely, irregularly punctured, somewhat reticulate, pubescence consisting of a few very fine, short, scattered, silvery hairs.

Scutellum bell shaped to oval, convex, finely sculptured, and shining.

Elytra as wide as pronotum; less than four times longer than length of pronotum; humeri nearly obsolete, humeral angles obtusely rounded; sides expanded behind base, sinuate to a point slightly behind apical third and then arcuately converging to apices, margins near apices finely, irregularly spinose; scutellar costae obsolete; second, fourth, sixth, and eighth interstrial spaces costate; second costa of each elytron entire, slightly sinuate, cristate, and smooth; fourth costa obsolete except at the middle where it is represented by slightly raised, irregular rows of rather coarse round punctures; remaining interstrial spaces bearing irregular rows of rather coarse round punctures; striae consisting of very deep and very coarse punctures which are variable in size and shape and which form a rough reticulation between the costae; surface glabrous except for a few very fine, short, silvery hairs along lateral margins near apex.

Under surface densely, rather coarsely punctured except for median areas, moderately clothed with short, fine, silvery hairs; front margin of prosternum very broadly lobed with the lobe broadly and shallowly emarginate in front; first abdominal sternite swollen medially, but swollen area with a flattened disk, hind margin broadly lobed at middle; hind margins of second, third, and fourth abdominal sternites more or less truncate; last abdominal sternite broadly triangular, lateral margins sinuate, apex feebly prolonged, hind margin very slightly notched, disk with a faintly indicated, median ridge. Fourth tarsal segment with a broad membranous lobe beneath.

Length: 10.5 mm. to 14 mm.

FEMALE: Differs from the male by having the first abdominal sternite flattened at middle and the last abdominal sternite with lateral margins feebly arcuate and apex rather broadly rounded.

Length: 14 mm. to 18.9 mm.

TYPE LOCALITY: Sequoia National Park, California.

RECORDED DISTRIBUTION: California: Sequoia National Park.

MATERIAL EXAMINED: California: Northfork, July 4, Sequoia National Park, July, 1931 (F. T. Scott); June, 1932; Potwisha, Sequoia National Park, July 1, 1941 (E. C. Van Dyke); Hammond, Sequoia National Park, June 18, 1947 (V. S. and F. M. Beer); Kaweah, June 28, 1931; July 4, 1931 (R. S. Wagner); Springville, Tulare County, August, 1933 (F. T. Scott); Tulare County, May, 1930 (F. T. Scott); Kernville, Kern County, June 16, 1947 (V. S. and F. M. Beer); Herkey Creek, San Jacinto Mountains, Riverside County, June 20, 1940 (W. F. Barr); Santa Rosa Mountain, Riverside County, June 5, 1946 (D. J. and J. N. Knull).

HOSTS: The recorded host of this species is *Quercus*. The specimen collected at Herkey Creek, San Jacinto Mountains, was beaten from *Ceanothus cuneatus*.

As mentioned previously, *P. cyanea* is most closely allied to *P. cazieri*, and it may be separated with certainty only after an examination of the male genitalia.

The specimen from Herkey Creek, San Jacinto Mountains, a female, differs somewhat from the other specimens of *P. cyanea*. The front of the head bears a distinct median carina, and the pronotum is twice as broad as long, being more broadly expanded than that of typical examples.

When this species was described by Chamberlin, he actually

had two species represented in his type series. The males were *P. cyanea* and the females were what he later described as *P. tularensis*. His original name, *P. cyaneous*, was undoubtedly based on the blue black color of the female specimens in his series. This name, of course, must stand since the holotype is a male specimen; however, it is here used in an emended form.

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 62

FRESH-WATER FISHES FROM CAPE YORK, AUSTRALIA

BY JOHN T. NICHOLS

The Richard Archbold Cape York expedition of 1948, though primarily interested in mammals, obtained a small collection of fresh-water fishes as opportunity offered, which are of considerable interest owing to the scarcity of such recently collected material from this area, and its proximity to New Guinea. The collection comprises 11 species, as listed below. One, and the race of another, of these appear to be previously undescribed.

Nematalosa erebi (Günther)

Chatoessus erebi GÜNTHER, 1868, Catalogue of fishes, vol. 7, p. 407.

Four specimens of between 105 and 115 mm. standard length from the Coen River (Gulf drainage), at an elevation of 700 feet, August 7.

Copidoglanis hyrtlii (Steindachner)

Neosilurus hyrtlii STEINDACHNER, 1867, Sitzber. Akad. Wiss. Wien, vol. 55, p. 14, pl., figs. 3, 3a (text ref. pl. 1, figs. 4, 5 incorrect).

Ten specimens between 85 and 145 mm. standard length from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 30 and 31.

Melanotaenia nigrans (Richardson)

Atherina nigrans RICHARDSON, 1843, Ann. Mag. Nat. Hist., vol. 11, p. 180.

Twenty specimens of between 40 and 95 mm. standard length

from Brown's Creek, Pascoe River (Pacific drainage), at an elevation of 200 feet, July 17 and 18; two of between 35 and 95 mm. from the North Claudie River (Pacific drainage) at little elevation, June 26. Eight specimens of between 25 and 60 mm. from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 31. Also six young of between 30 and 45 mm. (species provisional) from Musgrave, elevation 400 feet, August 29 (pools on Pacific side of divide), and Ebagoola, elevation 900 feet, August 27 (pools on Gulf side of divide).

Melanotaenia carteri (Whitley)

Aidaprora carteri WHITLEY, 1935, Rec. Australian Mus., vol. 19, p. 224.

Three specimens of between 45 and 85 mm. standard length from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 30 and 31; six of between 80 and 95 mm. from the Coen River (Gulf drainage), elevation 700 feet, August 7.

Glossamia gillii (Steindachner)

Apogonichthys gillii STEINDACHNER, 1867, Sitzber. Akad. Wiss. Wien, vol. 55, pt. 1, p. 11, pl., fig. 2 (text ref. pl. 1, fig. 1 incorrect).

Three specimens of between 35 and 70 mm. standard length, two from Brown's Creek, Pascoe River (Pacific drainage), elevation 200 feet, July 18; one from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 31.

Ambassis reticulata Weber

Ambassis interrupta var. *reticulatus* WEBER, 1913, Nova Guinea, vol. 9, livr. 4, p. 574. New Guinea.

Two specimens of between 45 and 50 mm. standard length, from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 31.

Therapon unicolor Günther

Therapon unicolor GÜNTHER, 1859, Catalogue of fishes, vol. 1, p. 277.

Eighteen specimens of between 45 and 70 mm. standard length from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 30 and 31; one of 84 mm. from the Coen River (Gulf drainage), elevation 700 feet, August 7; two of between 40 and 50 mm. from Ebagoola, elevation 900 feet, August 27, pools Gulf side of divide; and two between 40 and 75 mm. from

Musgrave, elevation 400 feet, August 29, pools Pacific side of divide.

Therapon bidyana (Mitchell)

Acerina Cernua bidyana MITCHELL, 1838, Three expeditions into the interior of eastern Australia, vol. 1, p. 95, pl. 8.

Pelates Römeri WEBER, 1910, Notes Leyden Mus., vol. 32, p. 233. New Guinea.

Nine specimens of between 60 and 110 mm. standard length from the Archer River (Gulf drainage), Wenlock Crossing, elevation 400 feet, July 30.

I identify these with *Pelates römeri* from New Guinea, and they are presumably *T. bidyana* as recognized elsewhere in Australia.

Therapon percoides yorkensis, new subspecies

Therapon fasciatus, CASTELNAU, 1878, Proc. Linnean Soc. New South Wales, vol. 3, p. 46, Norman River; not *T. fasciatus* Castelnau, 1876, Researches on fishes of Australia, p. 11, Swan River.

Characterized by small mouth, pointed snout, the top of the upper jaw on a level with the lower margin of the eye, high scale count, and bold colors. Dorsal, XIII (rarely XII), 9 or 10. Anal, III, 8 or 7. Scales, 41 to 47 (average 44). Four narrow, vertical black bands from back across sides, the first just behind head, fourth from a semi-oval blotch in the center of soft dorsal base to last anal rays; a fifth variable, more or less imperfect band on side of peduncle, and sixth blotch or bar on caudal base.

DESCRIPTION OF TYPE: No. 18535, the American Museum of Natural History, from the Coen River, Cape York, Australia, at 700 feet elevation, August 7, 1948, collected by G. M. Tate and H. M. Van Deusen.

Length to base of caudal, 75 mm. Depth in this length, 2.6; head, 3.2. Eye in head, 3; snout, 3; interorbital, 3.5; maxillary, 4; width of body, 1.7; least depth of peduncle, 2.5; its length, 2.2; longest dorsal spine, 1.5; dorsal ray, 2.2; anal spine, 1.6; anal ray, 2.2; length of caudal, 1.4; of pectoral, 1.5; ventral, 1.4; its spine, 2.1.

Dorsal, XIII, 9; anal III, 8. Scales (lateral line), 45. Gill-rakers (on lower limb), 13.

Compressed, back elevated, snout pointed, upper outline more convex than lower. Profile almost evenly convex, slanting up straight to over eye where there is a slight backward angle, then a

slight upward angle at the rounded nape. Mouth small, little oblique, the lower jaw appreciably included; maxillary concealed except for its end, to under posterior nostril. Nostrils well separated, the anterior nearer the edge of preorbital than to the posterior, which is not far from the front border of the eye. A series of close-spaced, blunt conical teeth in jaws, and band of small teeth behind it. Preopercle with strong serrae; opercle with one or two spines, the upper obscure. Gill-rakers short and thick.

Dorsal spines strong, the first small, and increasing in length to the fifth which is about four times the first, fifth to seventh subequal, then decreasing to next to last which is about one-half as long as the fifth and appreciably shorter than the last. Anal spines strong and heavy, the second about twice the first and appreciably longer than the third. Caudal emarginate. Ventral origin about under that of dorsal, and behind pectoral base. Ventrals pointed, not reaching vent when depressed; pectoral very bluntly pointed.

Moderate-sized ctenoid scales on back and sides; somewhat smaller scales on breast, opercle, cheek, postorbital, and apparently a few on base of preopercle; top of head, preorbital, snout, and jaws scaleless. Lateral line normal. Spinous dorsal, front of soft dorsal, and entire anal with a basal sheath of scales; small scales on the base of caudal which extend rather well out near its upper and lower margins. Tips of four sharp spines on hind edge of suprascapular (post-clavicle) exposed. No enlarged ventral axillary scale.

General color (in alcohol) dark along the back, becoming pale on lower surfaces. Four narrow, black, vertical cross bands downward from the back, the first close behind the head, its narrowed lower end curving backward slightly to behind the pectoral base, crossing about two-thirds the depth of body; the second and third crossing more nearly four-fifths the depth; the fourth is complete from the center of the soft dorsal onto the base of the posterior anal rays. In addition there are a more or less vertical black blotch on the peduncle and another on the base of the caudal. A dark lengthwise streak from edge of preorbital across cheek below eye. Spinous dorsal dusky, especially the membranes; soft dorsal with a basal semi-oval black blotch confluent with the fourth cross band, a vague dusky central band, and dark front margin and tip; anal pale, irregularly dusky on its front rays;

caudal pale with a black lower border, narrowly dusky upper border, broken dark stripes paralleling these inward, and two faint cross bars indicated across the middle of the fin. Outer rays of ventral dusky, inner pale; pectoral pale with a faint dusky cross mark on its base.

Nineteen specimens of between 40 and 90 mm. standard length from the Gulf side of the divide; 11 of between 45 and 90 mm. from the Archer River at 400 feet elevation, July 30; seven of between 55 and 75 mm. from the Coen River at 700 feet, August 7; one of between 40 and 45 mm. from pools at Ebagoola, 900 feet, August 27.

Their depth varies between 2.5 and 2.6 irrespective of size (2.8 in an exceptional one of 60 mm.). The color pattern is reasonably constant. A dark stripe from eye to snout is frequently appreciable. Especially in the Coen River material, a central and two lateral curving narrow dark stripes may be present on top of the head. The peduncular band may be complete or merely a blotch, the blotch on base of caudal a vertical bar or a round spot. The caudal is sometimes variously spotted or streaked with black, and its dark cross marks, present in the type, are absent in other specimens. The interspaces between the four main cross bands on the sides are sometimes variously marked with dusky, with a suggestion of central lengthwise band posteriorly in some Archer River specimens. These do not look exactly like those from the Coen River, and sufficient comparable series would probably show some population differences.

This is probably the race Castelnau had from the Norman River, but it is very unlikely that it is the one he described earlier from the Swan River in southwestern Australia. There is no reason to suppose that *Datnia fasciata* Steindachner, 1867 (Sitzber. Akad. Wiss. Wien, vol. 56, pt. 1, p. 322), obviously a *T. percoides* with prior claim to the name "*fasciatus,*" is this Cape York fish. Whereas Ogilby and McCulloch, 1916 (Mem. Queensland Mus., vol. 5, pp. 106–107), are probably right that *percoides* shows minor population variations best disregarded in taxonomy, it will prove advantageous to recognize a few of the major geographic variations.

ARCHERIA, NEW GENUS

This genus is proposed for a fish so closely resembling *Gilbertia jamesoni* (Ogilby) in shape, color, miscellaneous characters, and

appearance that it might easily be mistaken therefor. However, it has 12 versus 10 dorsal spines and a much weaker mouth with reduced dentition. It appears to be a less actively free-swimming fish somewhat related to *Therapon percoides*, but with sufficient aberrant characters (projecting lower jaw, elevated nape, etc.) to take it out of the genus *Therapon*.

Archeria jamesonoides, new species

A theraponid resembling marine *Gilbertia jamesoni* (Ogilby) in shape, color, and appearance, but with smaller, weaker mouth and different fin formulae.

Description of Type: No. 18533, the American Museum of Natural History, from the Archer River, Cape York, Australia, at Wenlock Crossing, 400 feet elevation, July 31, 1948, collected by G. M. Tate and H. M. Van Deusen.

Length to base of caudal, 52 mm. Depth in this length, 2.4; head, 2.8. Eye in head, 3.3; snout, 3.5; interorbital, 4; maxillary, 3.2; width of body, 2; least depth of peduncle, 2.8; its length, 2.8; longest dorsal spine, 2.3; dorsal ray, 2.5; anal spine, 2.4; anal ray, 2.5; length of caudal, 1.6; of pectoral, 1.5; ventral, 1.5; its spine, 2.5.

Dorsal, XII, 13; anal, III, 10. Scales, 58. Gill-rakers (on lower limb), 11.

Body compressed; upper profile almost straight to nape, slightly concave where top of the head meets the elevated nape and back, lower profile almost equally, more evenly convex, with a blunt angle at the anal origin. Mouth moderately oblique, the lower jaw slightly projecting; maxillary concealed, except for its end, to under front margin of eye. A series of bluntly pointed teeth in jaws, with minute teeth (difficult to find) behind them. Mouth otherwise toothless. Preopercle with strong serrae, those at and below its angle blunt; opercle with two spines, the upper very small. Gill-rakers short and thick.

First dorsal spine small, the spines increasing in length to the fifth, fifth to seventh subequal, then decreasing somewhat to the last; first and second weak, the other strong. Anal spines strong, the second and third subequal, the first shorter. Caudal subtruncate, slightly emarginate with rounded corners. Ventral origin slightly behind pectoral axil, first ventral ray ending in a short filament which does not quite reach vent when the fin is depressed; end of pectoral rounded.

Body and opercle with moderately small ctenoid scales. Lateral line normal. Scales on cheek much smaller, increasing somewhat in size around to behind the eye. Top of head, snout, jaws, and apparently preopercle scaleless. Spinous dorsal and entire anal fin with basal sheathes of scales; base of caudal well scaled, and of soft dorsal scantily so. Suprascapular (post-clavicle) concealed by scales except the tips of two approximate flat spines on its hind margin. No noticeable ventral axillary scale.

General color (in alcohol) irregularly dusky, paler from throat to ventrals, with irregular pale markings. These form two broken pale stripes from upper and lower part of eye backward over opercle; a pale stripe from the corner of the mouth back across the cheek, separated from the eye by a dark stripe, and with a less defined one bordering it below. Pale blotches on sides which tend to fall into vertical series, small on the front of the back, large on the peduncle, where they cover as much space as the ground color. Vertical fins dusky, the soft dorsal darker at the base, anal paler at the margin; pectorals grayish, ventrals black.

A single specimen, the type, as above.

The striking resemblance of theraponid *T. percoides* and *Archeria jamesonoides* (especially the latter) to Australian marine serranoid *Gilbertia semicincta* and *jamesoni*, respectively, is remarkable. It is sufficiently close to suggest mimicry, but in the nature of the case mimicry seems unlikely. True relationship may be possible. *Gilbertia* is one of the more typical marine serranoids, and one thinks of less typical families and genera as derived from such. These two Australian fresh-water forms might have evolved in the new environment from invasion by the two mentioned forms of *Gilbertia*. It seems less likely, however, that so great generic, even family, differences, while retaining species resemblances, should have evolved in fresh water—less likely than in shore waters where fish competition is greater and evolution presumably more rapid. Is it possible that one's original concept is wrong—the modern serranid fishes derivative from, rather than ancestral to, related families, their resemblance one to the other a matter of habitus rather than of heritage?

Mogurnda mogurnda (Richardson)

Eleotris mogurnda Richardson, 1848, The zoology of the voyage of H.M.S. Erebus and Terror..., Ichthyology, p. 4, pl. 2, figs. 1–2.

A single specimen of 97 mm. standard length from the Peach

River (branch of the Archer, Gulf drainage), elevation 800 feet, August 10.

Of the 11 species in the collection nine were taken from the Archer River; of the other two, one from its branch, the Peach River, one from the Coen River, also Gulf drainage. Only three were taken from the Pacific side of the divide, *Melanotaenia nigrans*, *Glossamia gillii*, and *Therapon unicolor* (two specimens from pools at Musgrave), all of wide distribution in eastern Australia. There are plenty of *Melanotaenia nigrans* from Brown's Creek (Pacific drainage), but besides that species only two specimens of *Glossamia gillii*, as contrasted with the nine species from the Archer River. This is presumably correlated with the less extensive Pacific slope drainage, its smaller rivers, and hence the relative paucity of its fish fauna.

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A NEW ADIANTHINE LITOPTERN AND ASSOCIATED MAMMALS FROM A DESEADAN FAUNULE IN MENDOZA, ARGENTINA

BY GEORGE GAYLORD SIMPSON
AND JOSÉ LUIS MINOPRIO[1]

ANTECEDENTS

The present paper is devoted to descriptions of a few fossil mammals from the Divisadero Largo formation in the Province of Mendoza, Argentine Republic. These strata had been noted in a cursory way long before, but the occurrence of fossil mammals in them was not known until 1936 when Sr. Adrián Ruiz Leal found a small hegetothere skull, which was later described by one of us (Minoprio, 1947). In 1943 and subsequently Dr. Olivo Chiotti made a geologic map of the area, a section of which was published in the cited work by Minoprio, and he also found other specimens which in 1945 were referred for identification to Dr. Ángel Cabrera, then of the Museo de La Plata. Dr. Cabrera's work has been interrupted, and descriptions of these fossils have not yet been published.

In January, 1946, Dr. Chiotti's study of the area resulted in a thesis entitled "Estratigrafía y Tectónica del Oeste de la Ciudad de Mendoza y Las Heras." This important and detailed stratigraphic study has not been published, but it is deposited in the Facultad de Ciencias Exactas, Físicas y Naturales of the Universidad de Córdoba, Argentina, and is available for consultation or loan. (It has been consulted by us.)

Sr. Carlos Rusconi, of Mendoza, became acquainted with the

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occurrence of fossil mammals in this area through the work of Chiotti and Minoprio and was guided to the fossil localities by Minoprio. With Sr. M. Tellechea he found various other fossils there, and he has published descriptions of some of these (Rusconi, 1946a, 1946b, 1946c). These papers and Minoprio, 1947 (published after Rusconi, 1946, but based on prior work by Chiotti and Minoprio), are the previous published references to this interesting new fauna.

OCCURRENCE

The fossils here in question were found in the Divisadero Largo formation at and near its type locality around and south of the eastern end of the Cerro Divisadero Largo about 8 kilometers west of the city of Mendoza. The regional geology and full stratigraphic sequence are highly complicated, but for present purposes it is sufficient to present a brief summary directly pertinent to the occurrence of the fossil mammals. This summary is based mainly on Chiotti's observations and data.

A thick and complex series of Paleozoic and Mesozoic rocks here terminates upward in a sharply defined erosional unconformity at the top of the "Estratos del Victor."[1] The age of these strata is not absolutely fixed but they are generally considered Rhaetic. Above this disconformity there are approximately 2200 meters of continental Tertiary rocks. These in turn are capped in places with strong angular unconformity by some 800 meters of conglomerate, called "Los Mogotes" and considered Pleistocene by Chiotti, a determination based on their structural and stratigraphic relationships as no fossils have yet been found in them.

The strata between the Estratos del Victor and the Conglomerado de Los Mogotes are also unfossiliferous except for the Divisadero Largo fauna near their base. On lithological grounds and on the basis of two apparent major disconformities, Chiotti has subdivided this series as follows:

Meters	
1550	*Serie del Higueral*
450	*Serie de las areniscas inestratificadas*
160	*Formación de Divisadero Largo*

[1] Beneath the "Estratos del Victor," the "Estratos de Cacheuta" and the "Estratos de Potrerillos" are both fossiliferous. The former contains *Estheria forbesi* and some *Thinnfeldia*, the latter more numerous *Thinnfeldia*.

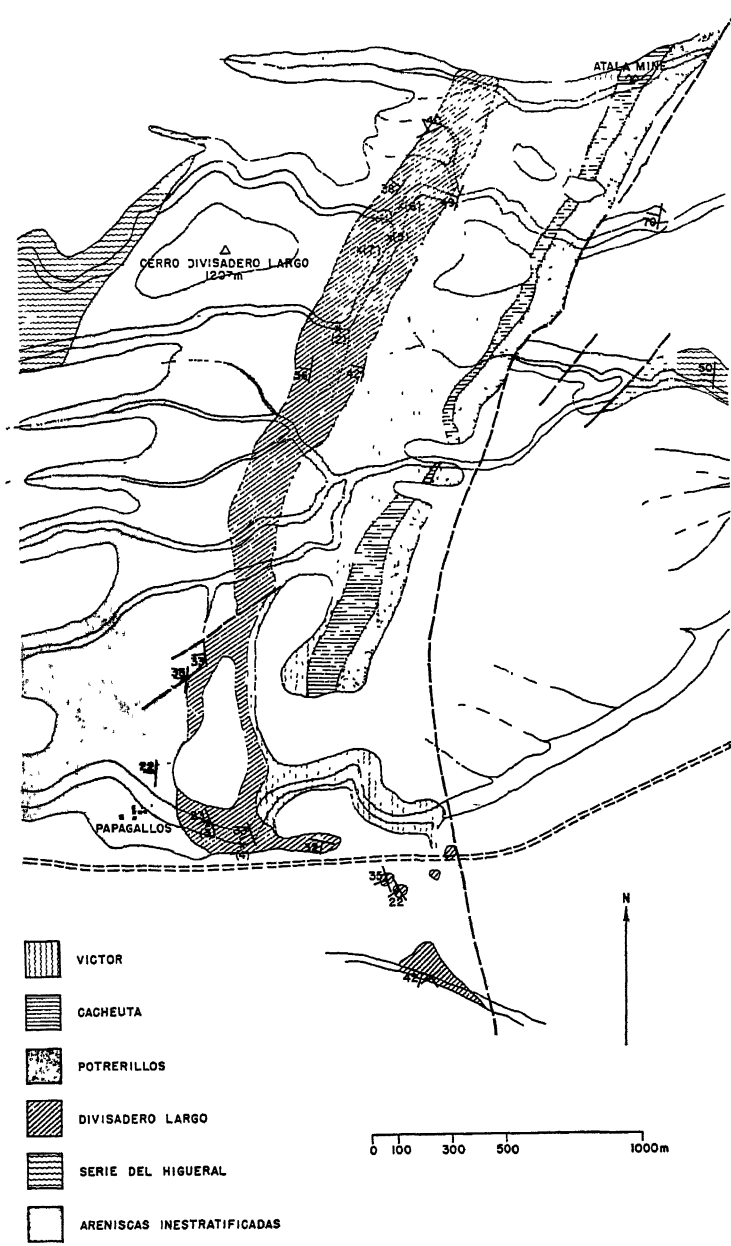

FIG. 1. Sketch map of the mammal-bearing exposures of the Divisadero Largo formation. Data from Chiotti, with some additions by Minoprio; drawn by N. Altshuler.

The structure is much complicated by faulting, but that part pertinent to the Divisadero Largo and its mammal localities is a broad syncline trending nearly north and south. The broad center of the syncline is formed by the Higueral beds, with the

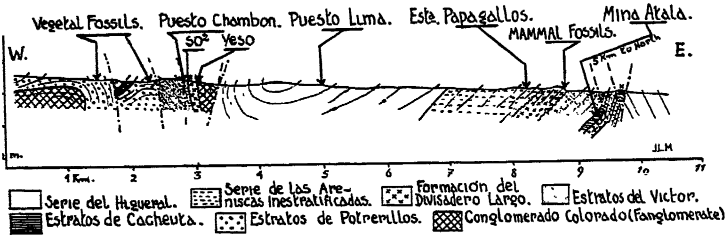

FIG. 2. East-west section through the Divisadero Largo mammal locality and adjacent structures, section A-A′ of Chiotti's manuscript. The eastern part of the section crosses the area shown on a larger scale in figure 1. Data from Chiotti, with some additions by Minoprio; drawn by Minoprio.

"unstratified sandstones" and the Divisadero Largo forming narrower zones in the more steeply folded sides of the syncline. The Divisadero Largo thus outcrops in two north-south bands on the two sides of the structure, between 5 and 6 kilometers distant

FIG. 3. Exposure of the Divisadero Largo formation at the east end of Cerro Divisadero Largo. Arrows indicate two of the fossil localities. Photograph by Minoprio.

from each other. The fossil localities are all in the eastern band, shown in the accompanying sketch map (fig. 1), section (fig. 2), and photograph (fig. 3). The following generalized section of the Divisadero Largo in this region is abbreviated from Chiotti's thesis:

Meters	
30	Variegated clays, reddish gray and violet, in beds 2–15 cm. thick, terminating above in a 60-cm. bed of pale gray argillaceous tuff
20	Maroon and gray, medium-grained sandstones alternating with thin beds of red and gray clay
60	Maroon and gray sandstones, partly conglomeratic, in beds 30 cm. to several meters in thickness. Fossil Mammals
45	Drab reddish sandstones, mostly fine to medium grained but with some conglomerate, in part micaceous, well stratified, and laminated
2–5	Compact, resistant, drab red conglomerate with lime and quartz pebbles up to 10 cm. in diameter. This rests with erosional disconformity on the Estratos del Victor and it also forms clastic dikes 2–7 cm. thick extending down into the older beds for distances of 4–5 meters

The age of these beds is probably Deseadan. The evidence for this will be discussed after consideration of the known fossil mammals.

DESCRIPTIONS OF MAMMALIAN FAUNA

ORDER LITOPTERNA

GEN. ET SPP. INDET.

Recently collected material includes a fragment of left lower jaw with roots of dm_4 or P_4 and M_{1-2} and a small part of an unerupted M_3. A fragment of right lower jaw with a broken, unerupted M_3, although not marked as associated, is probably part of the same individual. These pieces represent an animal of about the same size as a jaw fragment with roots of P_3–M_3 previously published (Minoprio, 1947, p. 376, fig. 6d and d′). The genus or species might be the same, but the specimens are too incomplete to warrant any positive conclusion. Minoprio compared the previously published fragment with *Paramacrauchenia* Bordas, but, as he fully recognized, it is so poorly preserved that this does not constitute an identification.

The present fragments are also so imperfect that they cannot be identified. Right M_3, the most significant part preserved, has the usually rather characteristic posterior end broken off. The remaining part could belong to a macraucheniid, although apparently not to *Paramacrauchenia*. It is, however, rather more similar to some of the Santacrucian and Colhuehuapian protérotheres, but not precisely like them. If these are its true affinities it probably represents a different and older genus. Comparison

with the Deseadan *Eoproterotherium* Ameghino and *Deuterotherium* Ameghino is desirable. As described by Ameghino, the unworn lower molars referred to *Deuterotherium* have the cusps more distinct and less fully merged into lophids than in the present M_3, which apparently cannot be congeneric with Ameghino's specimen. Lower molars of *Eoproterotherium* have not been described. In describing that genus, Ameghino said that he had lower as well as upper molars, but no descriptions or figures of lower teeth have been published. The present form must be listed merely as an indeterminate litoptern until better specimens are found and wider comparisons become possible.

FAMILY MACRAUCHENIIDAE

SUBFAMILY ADIANTHINAE

ADIANTOIDES, NEW GENUS

TYPE: *Adiantoides leali*, new species, *infra.*

KNOWN DISTRIBUTION: Deseadan, Divisadero Largo formation, Mendoza, Argentina.

DIAGNOSIS: A fully brachyodont adianthine litoptern with dentition somewhat similar to that of *Proadiantus* but probably closer to *Adianthus*. P^2 obliquely triangular, smaller and less transverse than P^3. P^{3-4} similar but progressively larger, strongly transverse, with persistent median internal fossette, very large and prominent parastyle, and labial face of protoloph posterior to the parastyle excavated, with basal cingulum. Postero-internal cingulum of P^4 barely larger than antero-internal cingulum and not cuspidate or projecting to form a hypocone. Upper molars relatively transverse, with projecting parastyles and ectolophs probably relatively simple posterior to parastyles. M^{1-2} with median internal and weak postero-internal fossettes, anterior cingulum apparently small and forming no, or only a very transitory, antero-internal fossette. M^3 short anteroposteriorly, obliquely triangular. Lower cheek teeth generally more as in *Proadiantus*, but talonids on M_{1-2} shorter and narrower than trigonids and M_3 strongly distinctive in having the talonid only slightly greater than the trigonid in length and much narrower, with entoconid continuing hypoconulid crest and barely differentiated, not forming a transverse crest.

The following genera have hitherto been referred to the Adianthinae, or the Adianthidae of Ameghino:

Pseudadiantus Ameghino, 1901; Casamayoran, Patagonia
Proadiantus Ameghino, 1897; Deseadan, Patagonia
Tricoelodus Ameghino, 1897; Deseadan, Patagonia
Proheptaconus Bordas, 1936; Colhuehuapian (Trelew formation and local fauna), Patagonia
Adianthus Ameghino, 1891; Colhuehuapian (typical) and Santacrucian, Patagonia

Pseudadiantus proves on restudy of the originals (observations by Simpson, in manuscript) to be an interathere (a synonym of *Notopithecus*) and must be removed from this group. *Tricoelodus* is a poorly known form probably also incorrectly referred to this group and in any case so unlike the other genera named or the present new genus that explicit comparison is unnecessary.[1] The previously established genera definitely of this group are thus *Proadiantus*, *Proheptaconus*, and *Adianthus*.

Adianthus shows some special resemblance to *Adiantoides*. The strong parastylar spur and absence of mesostyle and metastyle on the upper molars are probably similar, although these characters are not certainly established for *Adiantoides*. The transverse rather than anteroposterior extension of the hypocone is more clearly similar. The relatively internal or, at least, not obviously external position of the median fossette is another resemblance. The relatively undifferentiated entoconids of M_{1-2} are also similar. On the other hand, the cheek teeth of *Adianthus* have higher crowns than those of *Adiantoides*, antero- and postero-internal cingula of the upper molars are stronger and form distinct fossettes, and the anterior lower premolars are apparently more progressive and molariform.

Comparison with *Proheptaconus* is limited by the facts that only M^2 and parts of P^4, M^1, and M^3 are known in that genus (see Bordas, 1936, and, especially, 1939) and that the upper molars are poorly known in *Adiantoides*. *Proheptaconus* is, however, markedly different in the anteroposterior elongation of the known teeth, not transverse as in *Adiantoides*, and the development of strong internal cingulum fossettes. The crowns are probably higher than in *Adiantoides*, and the sculpturing of the labial face of the ectoloph is probably different.

Comparison with *Proadiantus* is made somewhat dubious by possible question as to the relationships of the various specimens referred to that genus. The type, *P. excavatus*, was based on a fragment of right lower jaw with P_{3-4} (Ameghino, 1897) and as

[1] Ameghino's general description of *Tricoelodus* mentions the first and second lower premolars (Ameghino, 1897), but he explicitly specified only a lower jaw fragment with three teeth which were said to be probably P_{2-4} in the text but labeled as P_{3-4} and M_1 (third to fifth molars of Ameghino's terminology) in the accompanying figure. It is possible that they are P_4 and M_{1-2}. Their figured structure is baffling as to affinities, and we are not aware that anyone has cast further light on this problem since Ameghino's original publication more than half a century ago.

far as we know no other specimens explicitly referred to that species have been described or figured. The original description of *P. pungidens* mentioned P_3–M_3 (Ameghino, 1901), and later (Ameghino, 1906) two fairly good specimens were figured, one with I_{1-3}, C, and P_2–M_2, and the other with M_{1-3}. Ameghino's description of M_3 in this species could be taken to imply comparison with *P. excavatus* and hence to indicate the existence of an undescribed M_3 referred to the latter species and with a shorter talonid than that of *P. pungidens*. Patterson (1940) took Ameghino's description to imply such a comparison. The point is important here because it is the larger, more complex talonid of M_3 in *P. pungidens* that most sharply distinguishes it from *Adiantoides*. We believe, however, that Ameghino was comparing M_3 of *P. pungidens* not with the same tooth in *P. excavatus* but with M_{1-2} of *P. pungidens*.

There is, in fact, little reason to doubt that *P. excavatus* and *P. pungidens* are congeneric, as Ameghino thought, and that the talonid development of M_3 as in *P. pungidens* characterizes the genus. Indeed Ameghino's descriptions and figures arouse a strong suspicion that *P. excavatus* and *P. pungidens* represent a single species and that the names are synonymous. As for Ameghino's third species, *P. gibbus*, his description (Ameghino, 1901) evidently implies, although, as usual in his diagnoses, it does not flatly state, that the type included only the anterior part of a lower jaw, without teeth, and an upper incisor. It may be doubted whether such remains were surely identifiable as to genus, and in any case they do not assist or enter into generic comparisons.

Upper cheek teeth of *Proadiantus* have been described only by Patterson (1940). Direct comparison with types or previous specimens was impossible because of the absence of homologous parts. Reference to *Proadiantus* was based on general congruence in size and structure with *P. excavatus* and *P. pungidens* and on the fact that no other adianthine genus was then known to occur in the Deseadan. It now appears that there are (at least) two Deseadan genera and also that it is not absolutely certain that *P. pungidens* is congeneric with the type of *Proadiantus*, *P. excavatus*. Patterson's upper dentition of *P.* sp. indet. and Ameghino's lower jaws of *P. pungidens* are certainly quite different from *Adiantoides* and probably are congeneric with each other. On the latter point, it is significant that Patterson's specimen has a markedly elongate M^3 and that an elongate M_3 is characteristic of *P.*

pungidens. That the genus thus represented is really *Proadiantus* is not at present susceptible of complete and rigid proof, but it is highly probable and must be accepted as a working premise if the taxonomy of the group is to be kept practicable.

If this conception of *Proadiantus* be used for comparative purposes, *Adiantoides* is certainly a distinct genus different from *Prodiantus* in many ways, the more important of which are incorporated in the preceding diagnosis. Differences in the upper teeth are in general similar to those between *Proheptaconus* and *Adiantoides*.

Comparative data are limited, especially as regards the later genera, now less well known than the Deseadan forms. It seems likely, however, that *Proadiantus* has special resemblance and relationships to the more advanced genus *Proheptaconus* and that *Adiantoides* has a similar relationship to the more advanced *Adianthus*. Special resemblance between *Proadiantus* and *Adiantoides* seems to be mainly in primitive characters and that between *Proheptaconus* and *Adianthus* in advanced characters. There seem, then, within the subfamily to be two groups or phyla, as follows:

Age	Phyla	
Santacrucian	Adianthus	
	|	
Colhuehuapian	Adianthus	Proheptaconus
	|	|
Deseadan	Adiantoides	Proadiantus

It is not clear and is somewhat improbable that the relationships within each phylum are exactly ancestral and descendent.

As regards the broader affinities of this group, Ameghino considered it as more or less closely related to the macraucheniids, and this view has not been seriously challenged. The only differences of opinion have been on the relatively unimportant point whether the group should rank as a separate family near the Macraucheniidae or should be placed in the Macraucheniidae. Ameghino (e.g., 1906) followed the former course, Scott (e.g., 1910) and most subsequent students the latter. Bordas (1939) proposed that two subfamilies be recognized in the Macraucheniidae, one for the present group and the other for all the other, typical or unquestioned, macraucheniid genera. Patterson (1940) supported this arrangement.

The present genus tends to bring out differences from, mere

than additional resemblances to, the typical macraucheniids or Macraucheniinae. The fact is that the genera studied by Bordas and by Patterson, *Proheptaconus* and *Proadiantus*, respectively, have the cheek teeth distinctly more similar to those of the Macraucheniinae than do *Adianthus* or *Adiantoides* (the latter, of course, unknown to Bordas or Patterson when they discussed this group). The skull of *Adiantoides*, as described below, seems to lack any definitely macraucheniine specializations. Extraordinarily primitive on the whole, it may also have some divergent specialization of its own, not in a macraucheniine direction.

It may be that the two phyla recognized above are not really closely related but are independent parallel or even convergent groups. In such a case, *Proadiantus* and *Proheptaconus* may represent an early and aberrant macraucheniid offshoot, while *Adiantoides* and *Adianthus* may be better placed in a separate family, a revival and emendation of Ameghino's Adianthidae. It would, however, be premature to jump to this conclusion on the present insufficient evidence. It does still seem more probable that these four genera of pygmy litopterns are related to one another and that they represent an offshoot from the remote macraucheniid ancestry. By Deseadan times, two lines within the group had become rather sharply distinct, and still more sharply distinct from the Macraucheniinae, but while awaiting better knowledge it seems preferable to retain them in a single subfamily, Adianthinae, of Macraucheniidae.

Adiantoides leali,[1] new species

Figures 4, 5

TYPE: Associated skull and jaws, incomplete, as described below.

HYPODIGM: Type only.

HORIZON AND LOCALITY: Deseadan age in the Divisadero Largo formation, 8 kilometers west of the city of Mendoza, Argentina.

DIAGNOSIS: Sole known species of the genus as diagnosed above. Measurements of type as in table 1.

The specimen consists of associated skull and jaws with parts, at least, of all teeth, upper and lower and of both sides. Many of the teeth are, however, severely damaged, particularly the crowns of the upper molars. The lower jaws are nearly complete through

[1] For Adrián Ruiz Leal, who found the first fossils in the Divisadero Largo formation.

M_3, but most of the post-dental part is broken away and lost. The skull is broken through just anterior to the jaw articulation and ear region, and the part posterior to this is lost. The face and anterior part of the cranium are severely crushed and broken, and many bits are lost, but most of the characters of these regions can be made out.

The dental formula is complete, $\frac{3\cdot1\cdot4\cdot3}{3\cdot1\cdot4\cdot3}$, and the tooth series are closed, without distinct diastemata. $I\,^{2-3}_{3}$, the canines, and P_1 are somewhat openly spaced from their neighbors, but the other teeth are closely crowded.

I^{1-2} are poorly preserved. They are small teeth, and the crown of I^2, at least, is somewhat expanded. I^3 is larger and has a well-developed, expanded crown with a spoon-like anterior flare. The posterior part is worn by contact with the lower canine. The upper canine is larger than I^3 and slightly larger in section and considerably higher than P^1. It is procumbent to about the same extent as I^3, and the crown, poorly preserved, has a similar but less prominent anterior flare.

P^1 is a small, obliquely triangular tooth with length slightly exceeding width. The labial face is rather smoothly rounded, with a weak cingulum. Coronal details cannot be determined. P^2 is similar in outline but with length and width nearly equal and with a prominent postero-internal protocone. The external cingulum is more distinct, and there are small but definite parastyle and metastyle folds. Very weak anterior and posterior cingula are present. P^3 and P^4 are closely similar to each other except for the greater size of the latter. The crowns are irregularly ovoid in plan and are markedly transverse. There is a large, rounded, unusually prominent parastyle fold or pillar on each, and the labial surface of the ectoloph posterior to the parastyle is excavated, with a sharp basal cingulum, terminated by a small metastyle crest. The face above the cingulum is broken and obscure, but no evidence of paracone, mesostyle, or metacone folds is seen. Antero- and postero-internal cingula are present, but they are small, subequal, the posterior cingulum perhaps a trifle larger than the anterior, without hypocone. The only coronal detail visible on the broken teeth is a persistent, median, relatively internal fossette immediately labial to the protocone apex.

M^{1-2}, badly preserved, are apparently similar except for the larger size of M^2. They are obliquely trapezoidal and wider transversely than long anteroposteriorly. There are a prominent

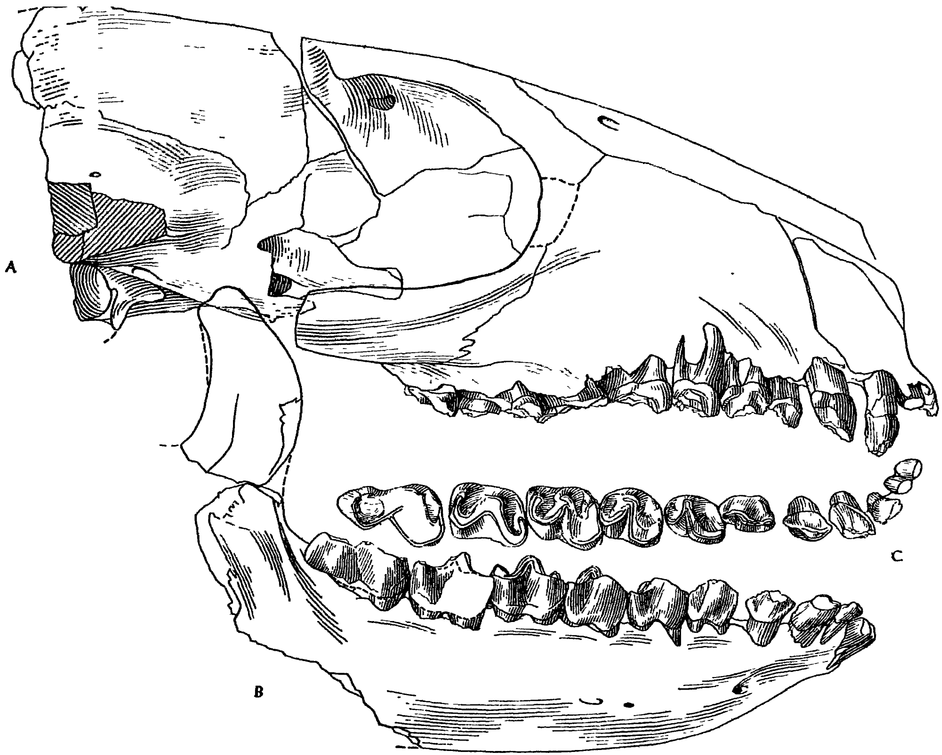

FIG. 4. *Adiantoides leali* Simpson and Minoprio. Type. A. Skull, lacking posterior part of cranium, right lateral view. B. Right lower jaw, lateral view. C. Right lower dentition, crown view. All twice natural size. Drawing by J. C. Germann.

parastyle projection and an external cingulum posterior to this. Other details of the labial wall cannot be determined clearly, but it seems probable that this wall was relatively simple and without pronounced folds other than the parastyle. On the lingual side of M^1 and probably but not surely of M^2 there are a sharp groove, well above the base, and a notch differentiating hypocone and protocone. Immediately labial to this notch is a median fossette. There is a metaloph, and posterior to this, posterolabial to the hypocone, is a cingulum that forms a much shallower fossette. The antero-internal cingulum is very small and forms no fossette or, at most, a shallow and evanescent one. Nothing can clearly be seen as to the pattern of the more labial half of the coronal surface. The crown of M^3 is more triangular and oblique, short anteroposteriorly and strongly transverse. There is a moderate postero-internal cingulum. Other details are lost by breakage.

The lower incisor roots increase slightly in diameter from I_1 to I_3. The crown of I_3 was apparently low and somewhat expanded. The lower canine is larger than I_3 or P_1. The outer face is smoothly rounded, and there is an anterior extension excavated and with basal cingulum on the lingual side.

P_1 is a small, simple, one-rooted tooth with rounded labial face, the anterolingual part slightly excavated, the transversely compressed main cusp followed by a tiny heel. P_2, markedly larger and two-rooted, is incipiently molariform and has well-differentiated trigonid and talonid, separated by a sharp, vertical labial groove. The trigonid is an anteroposterior blade rounded on the outer and excavated on the inner face. The much smaller talonid is feebly excavated lingually. P_3 is intermediate in structure between P_2 and P_4, but with definite molarization and more nearly like P_4. P_4 is fully molariform and differs essentially from M_1 only in having a relatively smaller talonid.

The essential pattern of P_4–M_2 is bicrescentic, lophiodont, with separate cusp tips not evident after moderate wear, at least. The paraconid wing of the anterior crescent is directly transverse and extends nearly as far lingually as the metaconid wing. The metaconid apex is somewhat expanded or crested posteriorly. The entoconid does not form a separate point or crest but is the lingual terminal of the simple talonid crescent. This end of the crescent is slightly swollen, and the entoconid apex may have been more or less distinct when unworn, but it is otherwise incorporated in the crest. Trigonid and talonid have pronounced

median valleys, open on the lingual side and not forming fossettes. Even on M_{1-2} the talonid is slightly shorter and narrower than the trigonid.

On M_3 the trigonid is badly preserved but was probably similar to that of M_1 or M_2. The talonid is elongated so that it is slightly longer than the trigonid, but the talonid is strikingly narrow, the difference from the trigonid in this dimension being greater than for the preceding teeth. The entoconid is relatively more anterior than on M_{1-2}, medial on the lingual side of the talonid, and it has a slightly differentiated apex, but it is almost completely incorporated in the simple talonid loop (rather than crescent) and shows no tendency to form a second crest or to be transversely elongated.

In general aspect and in many of its details the skull is that of a very primitive, almost generalized ungulate, resembling a small condylarth or some of the least progressive early notoungulates. It is almost, but not completely, devoid of any particular litoptern characters. On the whole, the skull is that of an unusually archaic or unprogressive litoptern which has preserved, as late as the Deseadan, many features of the ancestral condylarths. The large, open orbit is median in the skull, the snout gently tapering and neither reduced nor elongated, the cranium relatively small and pyriform.

In strong contrast with more typical litopterns, there is no regression of the nasals or of the external nares. The nasals are long and slender, moderately expanded posteriorly and slightly anteriorly. They retain sutural contact with the premaxillae, and this is relatively long, about 9 mm. The nasals are broken off at the anterior end of this suture, but this is probably near their ends and their free projection must have been short or lacking. They extend at least as far forward as a vertical from the anterior edge of I^3. The premaxilla has a relatively large, flat, ascending facial plate and does not have a distinct palatal process. The maxilla has a long nasal suture and meets the frontal above the lacrimal. The lacrimal outline is not entirely clear, but this bone seems to have a moderate facial exposure. The lacrimal foramen is within the orbital rim. The infraorbital foramen, not well preserved, seems to have been single and above the posterior end of P^3 or anterior part of P^4.

The base of the zygoma, simple and little expanded laterally, is opposite M^3 and the posterior part of M^2. The large jugal ex-

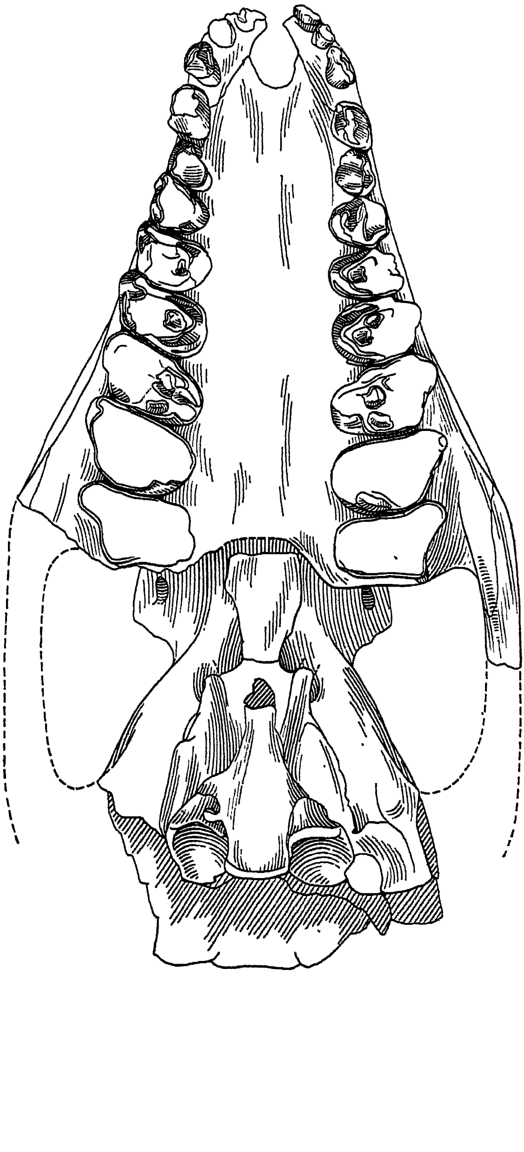

FIG. 5. *Adiantoides leali* Simpson and Minoprio. Type. Skull, lacking posterior part of cranium, ventral view. Twice natural size. Drawing by J. C. Germann.

tends well around the orbital rim and has a small contact with the lacrimal. The zygomatic process of the squamosal is not preserved, but the extent of the preserved parts of the jugal suggest that this process was confined to the posterior part of the zygoma and probably formed no definite postorbital process. The simple, tabular frontal does have a small postorbital process, much less prominent than in *Theosodon,* for example, and without a foramen.

The small cranium is markedly compressed anteriorly. An endocranial cast has not been prepared, but it can be seen that the brain was very unprogressive, with small, pyriform cerebral lobes and relatively large olfactory bulbs serially anterior to the cerebrum.

The choanae are poorly preserved, but apparently the palate was less excavated posteriorly than is usual in litopterns and ended opposite about the middle of M^3. Crests ascending from the pterygoid processes and running laterally towards the ear region are rather more like those of some Santacrucian prototheres (e.g., *Diadiaphorus*) than macraucheniids (*Theosodon*), doubtless the more primitive litoptern condition.

The specimen as preserved ends posteriorly at the open basisphenoid-basioccipital suture. At each side of the basisphenoid here and mainly above the level of its ventral surface is the hemispherical anterior part of a cavity walled by a bone distinct from the basisphenoid or alisphenoid and perhaps, but not certainly, from the squamosal. This is the most aberrant feature of the known parts of the skull, and it sharpens regret that the ear region is not preserved beyond this puzzling feature. The cavity looks like part of a tympanic bulla, but it is too high and too anteromedial for a normal bulla, and inflated bullae are (otherwise?) unknown in litopterns. Litopterns do have an epitympanic cavity (Simpson, 1933), not homologous with that of the notoungulates, but this lies in the squamosal near the posterior zygomatic base and does not form an exposed swelling or lie next to the basisphenoid as in this specimen. The notoungulate epitympanic cavity is in a totally different position. The cryptic structure of this specimen hints that *Adiantoides* had a peculiar ear region, but speculation as to its precise nature and implications seems futile, and it can only be hoped that further collecting will reveal a complete basicranium of this extraordinary little animal.

The large optic foramen is relatively posteroventral, deep in the orbit. The interorbital wall here, above the basisphenoid

and below the tapering, dorsally situated anterior end of the endocranial cavity, is thin, and the opposite optic foramina are confluent as preserved. This condition could be original but is probably caused by postmortem destruction of a paper-thin bony septum. The foramen lacerum anterius and foramen rotundum are probably confluent (as usual in litopterns). The opening is large and is immediately postero-ventro-lateral to the optic foramen, with the corresponding canals separated by a moderately stout bony wall. A possible, but uncertain, foramen ovale is seen as a rather small, somewhat slit-like opening in the alisphenoid at a point lateral to the anterior end of the sinus mentioned in the last paragraph.

The mandible is rather shallow and stout, the lateral surfaces rounded. The stout, procumbent, fully fused symphysis ends beneath about the middle of P_2. There are a mental foramen beneath P_1 and another, smaller, beneath P_4. On the right side, but not the left, there is another, still smaller foramen beneath the posterior end of P_3.

Measurements of the teeth of the type are given in table 1.

TABLE 1

MEASUREMENTS, IN MILLIMETERS, OF THE TYPE OF *Adiantoides leali*

(All measurements of upper teeth are approximations only)

	I^1–M^3	I_1–M_3	P^{1-4}	M^{1-3}	P^1–M^3	P_{1-4}	M_{1-3}	P_1–M_3
Length	37	39	14	14	27	15.6	16.5	32.3
	P^1	P^2	P^3	P^4	M^1	M^2	M^3	
Length	3	4	4	4½	5	5½	4½	
Width	2½	4	5½	6½	7½	8	7½	
	P_1	P_2	P_3	P_4	M_1	M_2	M_3	
Length	3.1	4.0	4.4	4.4	5.2	5.4	6.8	
Width	1.9	2.4	2.9	3.7	4.0	4.3	3.8	

Skull measurements of the distorted specimen would be too inaccurate to have much value and are sufficiently suggested by the accompanying figures.

ORDER NOTOUNGULATA

FAMILY INTERATHERIIDAE

GEN. ET SP. INDET.

One of us has previously figured a fragmentary lower jaw tentatively identified as *Interatherium* sp. (Minoprio, 1947, fig. 6c and c′). Further study shows that this specimen must be excluded from the genus *Interatherium*, although it probably does belong to the same family. The tooth pattern is so unusual that a new form may be represented, but the material seems to us insufficient for useful definition, and its description is deferred with the hope of finding more adequate specimens.

FAMILY MESOTHERIIDAE

Trachytherus mendocensis,[1] new species

Figure 6

TYPE: Four associated upper cheek teeth and fragments of at least three others, as specified below.

HYPODIGM: Type only.

HORIZON AND LOCALITY: Deseadan age, Divisadero Largo formation, about 8 kilometers west of the city of Mendoza, Argentina.

DIAGNOSIS: Much smaller than other known species of this genus. P^{2-3} strongly transverse, obliquely triangular in section, without grooves or ridges on rounded outer face. M^1 trapezoidal in section, almost as wide as long in middle wear stages, outer face smoothly curved, as on premolars, without grooves or ridges. M^2 more angulate at antero-external corner, outer face more as in Patagonian species.

The teeth that represent this species are all loose and in part broken, but they seem to be associated, and they are character-

FIG. 6. *Trachytherus mendocensis* Simpson and Minoprio. Type. Right P^{2-3} and M^{1-2}, crown views. Twice natural size. Drawing by J. C. Germann.

istic. Three teeth of the right side have their extra-alveolar parts complete, although the basal parts are broken. These are

[1] From the locality in the Province of Mendoza and near the city of that name.

identified as P^{2-3} and M^1. These identifications are almost certainly correct, unless the species should prove when better known to represent an allied but distinct genus, and even in that case the placing may be the same. There are also a left P^2 with the extra-alveolar portion complete and two fragments of left M^1. M^2 is represented by the broken inner part from the right side and a smaller fragment of this part as well as an antero-external fragment from the left side.

The wear stage is near that of Ameghino's figured specimen of *T. spegazzinianus* (Ameghino, 1889, pl. 79, fig. 1, and fig. 7 of the present paper), with coronal pattern obliterated from P^{1-2}, M^1 with the characteristic Y-shaped infolding of the inner wall, and M^2 with the median lobe reaching the inner side and openly exposed there. The general characters are those of *Trachytherus*, and there can be little doubt that a close relationship exists. It is, of course, impossible to discount the chance that complete dentitions or skulls might reveal more important differences.

The Patagonian species is, or are, so variable that the apparent, rather slight morphological differences noted in the diagnosis or

FIG. 7. *Trachytherus spegazzinianus* Ameghino. Right P^2–M^3, crown view. For comparison with *T. mendocensis*, figure 6. About two-thirds natural size. Photograph by W. B. Scott.

visible in the figure are of doubtful taxonomic value. The difference in size is, however, sufficient in itself to validate the species, pending better establishment of the other diagnostic differences that doubtless do exist.

Ameghino defined two species from the Deseadan of Patagonia (probably both from Cabeza Blanca): *Trachytherus spegazzinianus* Ameghino, 1889, and *T. conturbatus* Ameghino, 1891.

Loomis proposed another from Cabeza Blanca: "*Eutrachytherus*"[1] *grandis* Loomis, 1914. Characteristic measurements of M^1 in these three species, given by their authors, and the same measurements for *T. mendocensis*, type, are as follows:

	Length	Width
T. grandis	29 mm.	21 mm.
T. spegazzinianus	19	23
	20	21
T. conturbatus	17	9[2]
T. mendocensis	9.1	8.3

Patterson (1934) has pointed out that the dimensions and other characters of the teeth in this genus are highly variable, both among different individuals and in different wear stages of teeth of the same individual. He concluded that the three proposed Patagonian species are probably synonymous. If this is correct (and there is no serious reason to doubt it), the size difference of *T. mendocensis* is even more surely of specific value. If the described Patagonian specimens are all of one species, "*T. conturbatus*" is an extremely small variant of that species, and the Mendoza fossil, so much smaller still, cannot belong in the same group. The only possibility of synonymy for the Mendoza fossil would arise if "*T. conturbatus*" were based on an extremely large variant of a distinct species of which the Mendoza animal is an extremely small variant. That possibility is so remote that it cannot be taken seriously.

Roth (1898) proposed a species "*Eutrachytherus modestus*" (cited by Ameghino, 1899, as "*E. modicus*," by a *lapsus*) from the Collon Curá beds of northern Patagonia. This was defined as half the size of *T. spegazzinianus*, which would make it about the size of *T. mendocensis*. As far as we know, Roth's specimen has never been figured, and his description is not detailed or entirely clear. It is, however, practically certain that his species does not belong in *Trachytherus*. The Collon Curá beds are at least as late as the Santacrucian and may be even a little later.

[1] *Eutrachytherus* was proposed by Ameghino in substitution for *Trachytherus*, supposedly preoccupied. Under the present Rules of Nomenclature the original name is valid.

[2] This figure is so extraordinarily small in comparison with the length that it may be a misprint. On the other hand, the type may be a very young tooth and the measurements those of the tapering top of the crown. Ameghino did comment that this dimension might increase with age. The tooth has not been figured.

The occurrence in them of a typically Deseadan mesothere is incredible. Roth's description could apply equally well to some later genus of Mesotheriidae ("Typotheriidae" of authors), or perhaps even to a member of some other family. There is no reasonable possibility that the Mendoza fossil belongs in his species, in spite of the similarity in size.

FAMILY **HEGETOTHERIIDAE**

Prohegetotherium carettei Minoprio, 1947

This species was based on an excellent skull and lower jaws previously described and figured (Minoprio, 1947, pp. 371–374, figs. 3–5). Drawings and photographs are here reproduced from the earlier publication (figs. 8–9). The much less well-

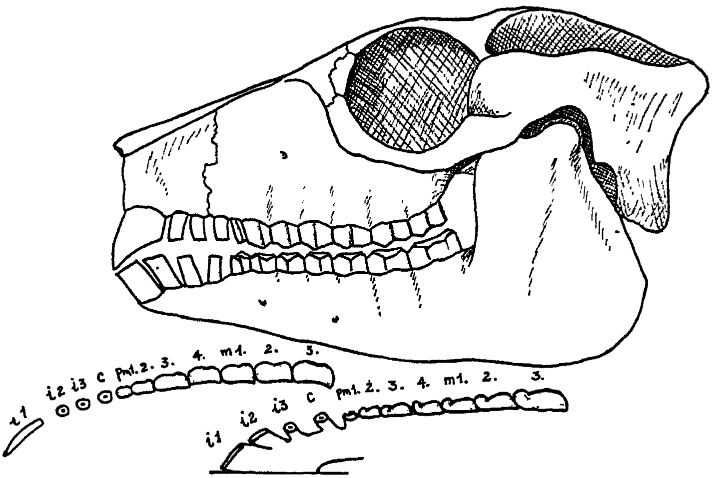

FIG. 8. *Prohegetotherium carettei* Minoprio. Type. Reconstruction of skull and jaws, left lateral view, and of upper and lower dentitions, crown views. Natural size. Drawing by Minoprio.

known genotype, *Prohegetotherium sculptum* Ameghino, differs most obviously in having the external sulcus of the upper molars distinctly more anterior in position. *P. shumwayi* Loomis is still more distinct in this respect and also has the antero-external angle of these teeth decidedly more acute and produced than in either *P. sculptum* or *P. carettei*.

Prohegetotherium carettei reveals a number of generic distinctions from *Hegetotherium* not known in *P. sculptum* or *P. shumwayi*.

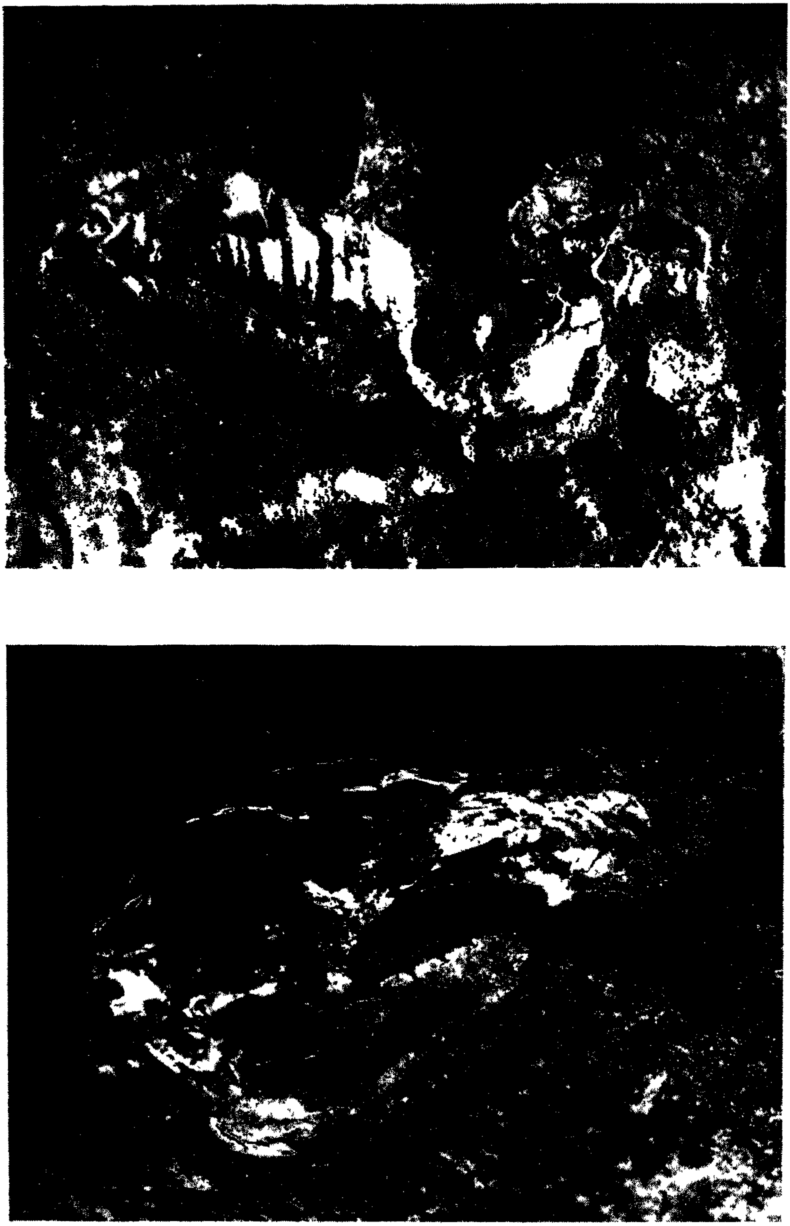

FIG. 9. *Prohegetotherium carettei* Minoprio. Type. Split slabs containing skull and jaws. Natural size. Photograph by Minoprio.

The most striking of these is the fact that *P. carettei* has P_1^1–P_2^2 in a closed and morphologically evenly progressive series, whereas *Hegetotherium* has P_1^1 and P_2^2 separated from each other and from the following teeth by small diastemata and sharply smaller in size and simpler in cross section than P_3^3.

? NOTOUNGULATA

GEN. ET SP. INDET.

Among hitherto undescribed materials there is a symphysis with all the incisors, both canines and first premolars and right P_2, most of these teeth somewhat broken. The specimen merits some mention, even though it is not identified at present. At first sight it resembles *Adiantoides*, but close comparison reveals differences that may accompany widely different systematic positions. The symphysis in the present specimen is more robust and extends as far as the posterior part of P_3. The lower canine is nearly like that of *Adiantoides*. The first premolar is relatively smaller than in *Adiantoides*. The second premolar shows a similar degree of molarization, but the crown is higher, and the tooth is more procumbent. The external groove differentiating trigonid and talonid slopes more distinctly forward as it rises. Such a tooth is somewhat more suggestive of a primitive notoungulate than of an adianthine, but the evidence is too slight for a positive conclusion. The animal was slightly larger than *Adiantoides leali*. The specimen is clearly distinct from *Allalmeia*, in which, as shown in Rusconi's sketch, P_2 is a tiny and completely simple tooth with no molarization whatever (see Rusconi, 1946). P_3 of *Allalmeia* may more nearly resemble P_2 of this specimen.

ORDER UNCERTAIN

GEN. ET SP. INDET.

Last among the hitherto unpublished specimens to be mentioned here are fragments of one individual of what seems to be a new and very strange animal. We consider these scraps insufficient basis for definition, but their occurrence is worthy of mention if only to stimulate further search for specimens of this fauna, which evidently contains many novelties.

A lower incisor is small and simple, not bilobed as in usual astrapotheres. The lower canine is enlarged, but less so than in astrapotheres, and it has a closed root and a crown of moderate

height, somewhat recurved, convex on the outer face and excavated on the edges of the inner face, rather like an enlarged notoungulate canine. No lower cheek tooth is completely preserved, but the better of two fragmentary teeth from this region seems to consist of a simple anteroposterior blade, laterally compressed, rising to a single median apex, followed by a low heel. This seemed to be in the position of a molar, but no animal with a molar like this is known to us. Interpretation as a premolar is morphologically less extraordinary, but still provides no close comparison among previously known forms.

An upper molar, probably M^3, preserves the apical pattern (fig. 10B). This at once excludes reference to the Borhyaenidae,

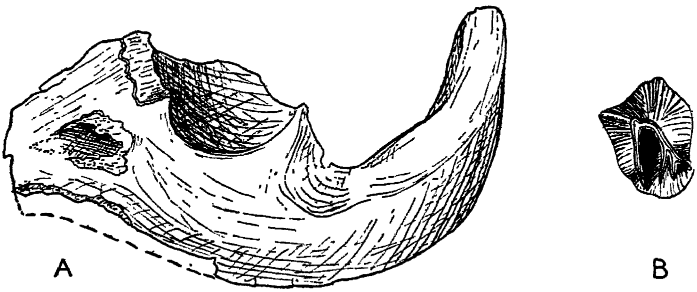

FIG. 10. Gen. et sp. indet. A. Fragment of skull with lower rim of orbit and part of zygoma, left lateral view. One-half natural size. B. Left M^3, crown view. Natural size. Drawing by Minoprio.

which might seem remotely possible on the basis of the very imperfect knowledge of the lower teeth. Reference to a small astrapothere of new and unusual type would be a possibility, and we were at first inclined to this view, but it is also possible that the pattern might be a modification of that seen in M^3 of some of the primitive toxodonts. (Cf. *Proadinotherium*, although reference to that genus cannot be supported.)

The only other characteristic fragment includes the lower border of the orbit and part of the zygoma (fig. 10A) which curves upward strongly and suggests a short, high cranium. This, too, is not well matched in comparative materials available to us, but is in some respects suggestive of both the astrapotheres and the toxodonts.

AGE OF THE DIVISADERO LARGO FORMATION

Before the discovery of fossils in these beds, they were sometimes confused with the older (probably Rhaetic) underlying beds, sometimes considered as belonging later in the Mesozoic and sometimes placed in various parts of the Tertiary. Chiotti's (unpublished) thesis definitely established their age as Tertiary and suggested that they belong rather in the Eogene than the Neogene. His fossils were submitted to Cabrera, and Chiotti cites Cabrera (personal communication) as stating that these fossils are early Eocene. This may indicate that Cabrera tentatively identified some of these fossils as Casamayoran. In view of our findings (below) this would almost certainly indicate the presence of two distinct faunal horizons and would raise serious difficulties because Chiotti's fossils were not apparently lower in the sequence than ours. Cabrera has not, however, made explicit identifications or published this material, and reference to the early Eocene, in indirect quotation from him, may therefore be taken as subject to correction.

Rusconi (1946a, 1946b, 1946c) called the beds "Atalaense." Although this was the first published separate designation for the mammal-bearing horizon, it was subsequent to Chiotti's better-documented designation of them in his unpublished but publicly available thesis as the Divisadero Largo formation. The term "Atalaense" is also unacceptable because it necessarily implies as type locality the Atala Mine, which is not on or in this Tertiary formation but a half kilometer from it at the nearest point and in the Cacheuta strata of late Triassic age. Rusconi gave the age as Oligocene, perhaps Deseadan. *Allalmeia*, the only mammal involved in Rusconi's notes, was compared mainly with long pre-Deseadan Casamayoran fossils.

In a previous paper on this fauna, one of us (Minoprio, 1947), with better fossil evidence than was directly available to previous students, concluded that the Divisadero Largo may provisionally be placed in the Deseadan. Our present study confirms this and seems to put it beyond serious doubt as an approximate correlation at least. An age slightly earlier or later than the typical Deseadan of Patagonia cannot, of course, be excluded when dealing with a few elements of what is clearly a faunal facies distinct from those previously known for this part of the column. All the positively identified species are new. The positively identified genera are as follows:

Adiantoides; genus unknown elsewhere, but more primitive than Colhuehuapian *Adianthus* or *Proheptaconus* and analogous in evolutionary advance to its Deseadan ally *Proadiantus*
Trachytherus; genus confined to the Deseadan as far as known
Prohegetotherium; genus confined to the Deseadan as far as known

Scanty as they are, these data warrant reference to the Deseadan and prohibit the establishment of a new provincial age or stage on the basis of present knowledge.

Rusconi has named a mammal, *Allalmeia atalaensis,* a bird, *Cunampia simplex,* and a reptile, *Ilchunia parca,* from these beds. These do not at present add to the evidence as to age.

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A NEW OLIGOCENE RODENT GENUS FROM PATAGONIA

By Albert E. Wood[1]

INTRODUCTION

The earliest known South American rodents are from the Lower Oligocene (Deseadan). Until recently all of the available material has been very fragmentary, consisting of isolated teeth, or fragmentary jaws, or, at best, of nearly complete lower jaws or palates with upper dentitions (cf. Loomis, 1914, p. 186; Wood and Patterson, in press). The discovery of two nearly complete and largely articulated rodent skeletons and of one partial one by the American Museum Scarritt Expedition in 1934 was therefore of very great interest. One of these specimens, A.M.N.H. No. 29600, is nearly complete, almost all parts of the skeleton being preserved, though the interpretation of some of them is difficult or impossible. The specimens are preserved in a thinly laminated bentonite, which compacted after deposition, with resulting compression of the specimens. For this reason it has been impossible to prepare the specimens as much as would otherwise have been desirable.

Since the Deseado is the earliest horizon in South America from which rodents have been found, these specimens are of great importance in connection with the recurrent problems of the origin of the South American rodents and their relationships, if any, to the Old World hystricomorphs.

The description of this material has been delayed until now by

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preparation and by the war. I wish to express my great appreciation to Dr. G. G. Simpson for lending these three specimens to me for study and description, and for arranging for the publication of the manuscript by the American Museum. This work was assisted by grants from the March Fund of the National Academy of Sciences.

Comparisons have been made with several other groups of rodents, listed below:

1. The contemporary and later (particularly Santacrucian and Recent) South American hystricomorphs, which are the forms, if any, descended from this type. For these comparisons I have drawn heavily on Tullberg (1899) and Scott (1905) and have not attempted to give them credit at every place where I have used their works.

2. The Eocene North American representatives of the Paramyidae and Sciuravidae, and such relatively little modified descendants as the Eocene and Oligocene Ischyromyidae. The author is engaged in an extensive study of the Paramyidae, from which it has already appeared that *Reithroparamys* is one of the more primitive of the better known members of the family, and hence many comparisons are made with that form. Comparisons with *Paramys delicatus* are based on the excellent skeleton (A.M.N.H. No. 12506) described by Matthew (1910). As far as can be told at present, the Paleocene or lower Eocene paramyids or sciuravids were most probably ancestral to the South American rodents.

3. The Theridomyidae and such other Old World forms as have been suggested in the past as possible ancestors of the South American hystricomorphs. For this section I have drawn on notes made in 1934 while visiting the European collections as Cutting Traveling Fellow in Columbia University, as well as on various published sources.

4. Such other rodents as seem to show certain habitus or heritage characters in common with the present material.

The forms actually used anywhere in this paper, for comparisons of any type, include those listed below, with their classification as based on the present scheme.

Suborder Protrogomorpha
  Superfamily Ischyromyoidea
    Family Paramyidae
      Paramys, *Reithroparamys*, *Ischyrotomus*

Family Sciuravidae
Sciuravus, Tillomys, Mysops, Pauromys, Taxymys
Family Ischyromyidae
Ischyromys, Pareumys, Titanotheriomys
Superfamily Aplodontoidea
Family Aplodontidae
Aplodontia
Suborder Sciuromorpha
Superfamily Sciuroidea
Family Sciuridae
Sciurus, Cynomys, Marmota
Superfamily Castoroidea
Family Castoridea
Castor
Superfamily Geomyoidea
Family Geomyidae
Family Heteromyidae
Heliscomys, Perognathus, Cupidinimus, Dipodomys, Heteromys, Liomys, Microdipodops
Suborder Myomorpha
Superfamily Muroidea
Family Cricetidae
Neotoma, Ondatra
Suborder Hystricomorpha
Superfamily Hystricoidea
Family Hystricidae
Hystrix
Superfamily Erethizontoidea
Family Erethizontidae
Coendu, Erethizon, Steiromys
Superfamily Cavioidea
Family Eocardiidae
Eocardia, Schistomys
Family Caviidae
Cavia, Dolichotis, Prodolichotis, Paradolichotis
Family Hydrochoeridae
Hydrochoerus, Prothydrochoerus
Family Dasyproctidae
Cuniculus, Dasyprocta
Superfamily Chinchilloidea
Family Chinchillidae
Chinchilla, Lagidium, Lagostomus, Perimys
Family Acaremyidae
Acaremys, Asteromys, Platypittamys, Sciamys
Superfamily Octodontoidea
Family Capromyidae
Myocastor, Neoreomys, Scleromys
Family Echimyidae
Echimys, Kannabateomys, Stichomys

Hystricomorpha inc. sed.
  Family Thryonomyidae
    Thryonomys
  Family Petromyidae
    Petromys
Rodentia inc. sed.
  Family Theridomyidae
    Theridomys, *Trechomys*
  Family Bathyergidae
    Bathyergoides, *Georychus*, *Bathyergus*
  Family Pedetidae
    Parapedetes, *Pedetes*
  Family Ctenodactylidae
    Ctenodactylus
  Inc. sed.
    Phiomys

In addition to these general comparisons, interpretations of the myology have been greatly assisted by a study of the situation as illustrated by A. B. Howell in his "Anatomy of the wood rat" (1926). The cusp terminology used for the teeth is that of Wood and Wilson (1936).

DESCRIPTION OF MATERIAL

FAMILY **ACAREMYIDAE**, NEW FAMILY

Small, ground-living, New World hystricomorphs, retaining a dental pattern clearly showing four subequal transverse lophs on both upper and lower molars. Infraorbital foramen enlarged, progressively transmitting the masseter. Temporalis small. Skeleton initially scampering, with tendencies towards cursorial adaptations. Feet pentadactyl, with first digit reduced. Tibia and fibula separate.

GENERA: *Platypittamys*, described below, and *Asteromys* from the Deseadan; *Protacaremys* and *Acaremys* from the Colhuehuapian; and *Sciamys*, *Acaremys*, and *Palmiramys* from the Santacrucian.

This family is a natural group of Oligocene and Miocene South American rodents. They may be characterized as being small, light-bodied, scampering to subcursorial, "hystricomorph" rodents, with relatively primitive, though progressively hypsodont, cheek teeth whose pattern is based on four transverse crests. This pattern appears to be basic for the South American hystricomorphs. The general structure, that of a small, pentadactyl, scampering rodent, also seems basic for this group.

The Acaremyidae have usually been considered a subfamily of the Erethizontidae, the Acaremyinae. As pointed out by Scott (1905, p. 421), the similarities to the Erethizontidae are very slight, other than in the dentition. This probably means that both groups have retained the basic South American hystricomorph tooth pattern. It seems probable, on the basis of the present study, that there is really nothing in particular that the Acaremyidae have in common with the erethizontids, other than this retention of the ancestral tooth pattern, which probably merely means that they have common Eocene ancestors. Therefore, since the acaremyids do not show sufficient similarity to any other family to justify their transfer to it, it would appear necessary to raise them to the status of a family.

The erethizontids appear to have followed a rather different evolutionary direction, at least since the Miocene, being much stockier, more slowly moving forms, largely arboreal, and presumably already having developed quills. Structurally they appear to be widely separated from the other South American rodents. In some respects the South American rodents seem to show a basic dichotomy into the erethizontids and the others, with the erethizontids having retained something like the primitive tooth pattern but having diverged in their other characters. If this is true, the Acaremyidae could very well represent the basic stock from which the other groups have been derived. This would seem to be a correct expression of the present state of knowledge of the subject. Since, however, it is still impossible to establish any direct phyletic relationships to the other groups of South American rodents, it seems best not to include the Acaremyidae in any of the superfamilies into which Simpson (1945) divided the hystricomorphs, but to consider them as representing a basic stock ancestral to the Cavioidea, Chinchilloidea, and Octodontoidea.

PLATYPITTAMYS,[1] NEW GENUS

GENOTYPE: *Platypittamys brachyodon*, new species.

DIAGNOSIS: An acaremyid with low-crowned cheek teeth and

[1] In view of the extreme crushing of the specimens on which this genus is based, I referred to it during the study as "pancake-mouse." I wish to express my appreciation to Professor and Mrs. C. H. Morgan of Amherst College for helping me in finding an approach to a Greek name for pancake. Unfortunately this seems to be one item for which the Greeks have no name, so the name of this genus is compounded from "pitta," a cake, and "platy," flat.

non-molariform premolars in which, apparently, the masseter had not yet begun to pass through the infraorbital foramen.

RANGE: Lower Oligocene (Deseadan) of the Scarritt Pocket, Patagonia.

Platypittamys brachyodon, new species

HOLOTYPE: A.M.N.H. No. 29600, a skeleton with skull, jaws, and most of the other bones, badly compressed. The skull is dorsoventrally flattened.

REFERRED SPECIMENS: A.M.N.H. No. 29601, a partial skeleton with the skull transversely flattened; and A.M.N.H. No. 29602, a partial skeleton without skull.

As mentioned above, these specimens were so badly crushed that their preparation, which was very skillfully done by the late Mr. Albert Thomson, was very difficult. In connection with the study of the specimens, only slight additional preparation was required. Where two bones lie on top of each other, it is completely impossible to separate them. For example, a humerus and a scapula are plastered over the palate of the holotype and are molded into the contours of the skull in such a way as to be completely inseparable from it, being essentially two-dimensional, and yet they completely conceal the structure of the ventral surface of the skull. In all the bones, this crushing and flattening is marked. It has been necessary, therefore, to restore all the bones to what is hoped is an approach to their original condition, both in the individual drawings and in the restoration (fig. 8). Only where restorations have been made of parts that are completely absent are they indicated by broken lines.

SKULL

The skull is preserved in two specimens, A.M.N.H. Nos. 29600 and 29601. In the former it is crushed dorsoventrally, the roof being exposed on one side and the lower jaws and palate on the other, the whole being only about 1 mm. thick. In A.M.N.H. No. 29601, the skull is flattened laterally and is slightly thicker. Because of the great crushing of both specimens, there is a considerable amount of guesswork in the restoration of the skull. It is frequently exceedingly difficult to distinguish sutures from the myriad cracks that criss-cross the bones. It is believed, however, that the statements that follow are substantially correct.

The skull as a whole was apparently rather slender, perhaps most nearly having the proportions of that of a rat or ground squirrel. Although there are similarities to the skull of *Sciuravus* (Matthew, 1910, fig. 13), the skull seems to have been less arched than in that form, and the jaw to have been proportionately larger. The antorbital region is about a third the length of the skull, as in other acaremyids and in *Ischyromys*, being appreciably longer than in *Paramys*, *Reithroparamys*, or *Sciuravus*, and the region behind the anterior end of the glenoid fossa is about a quarter the length, as in other acaremyids and in the paramyids and *Sciuravus*. As in most primitive rodents, the basicranial axis is nearly straight.

The skull, as is usual in small rodents, seems to have had an inflated braincase, with little or no trace of crests, and a generally fairly flat dorsal surface, with a slight arch in the frontal and parietal regions as in *Reithroparamys* and the ischyromyids. This likewise appears to have been true in *Acaremys* and *Sciamys* (Scott, 1905, pl. 66, fig. 11; pl. 67, figs. 1, 4, 9, 10), although in the former there is a slight sagittal crest. *Paramys* and *Reithroparamys*, both being larger, show clearly marked ridges around the temporal fossa. *Sciuravus* does not. The snout presumably was essentially tubular in dorsal view and was rather similar in shape to that of *Sciuravus*. This tubular character does not seem to be present in later acaremyids. The breadth of the occipital region of *Platypittamys* may be exaggerated in figure 1. It seems especially likely that the external auditory meatus was not visible from the dorsum, but it is so visible in A.M.N.H. No. 29600 and is hence restored that way. It was not visible in *Reithroparamys*, *Sciuravus*, or *Sciamys*. There appears to have been no postorbital constriction, agreeing with the Hystricomorpha in general and the other acaremyids in particular and in contrast to *Paramys*, *Reithroparamys*, and ischyromyids. This would indicate a relatively larger brain, which may merely be correlated with the difference in size, although since the larger hystricomorphs agree with *Platypittamys* and since the small *Sciuravus* agrees in this respect with the paramyids, it probably indicates an increase in size of the frontal part of the brain in *Platypittamys*. The eyes were fairly large, and looked forward and outward as in *Acaremys*, *Sciamys*, *Reithroparamys*, *Sciuravus*, and squirrels, rather than upward as in *Paramys*, *Ischyromys*, *Aplodontia*, and many other rodents. The size of the bullae and the upward orientation of the meatus

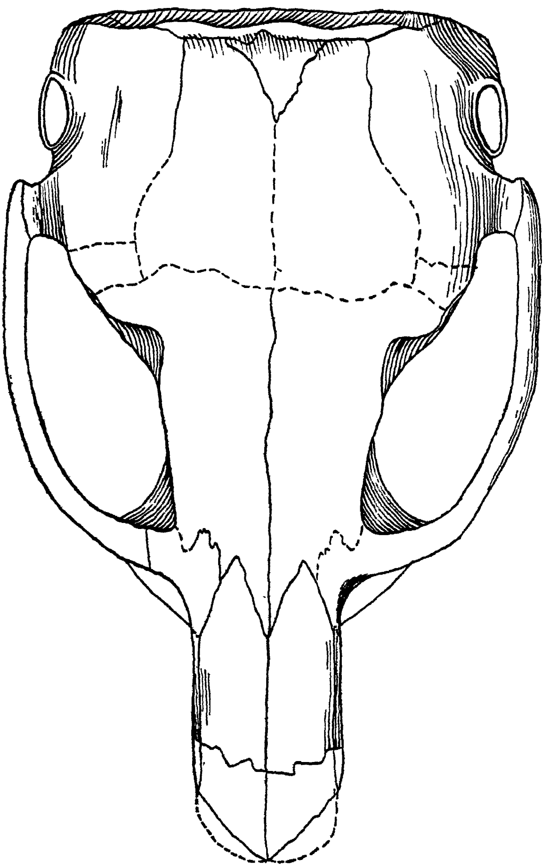

FIG. 1. *Platypittamys brachyodon.* Top view of skull, based largely on A.M.N.H. No. 29600, with additions from A.M.N.H. No. 29601. × 3.

are quite suggestive of *Acaremys*, *Ischyromys*, *Titanotheriomys*, and *Chinchilla*. They are proportionately larger than in *Reithroparamys* and are not preserved in *Paramys* or *Sciuravus*, suggesting either that they were not ossified in these forms or that the ectotympanic had not yet established firm relationships with the skull.

The nasals (figs. 1, 2A) are long and slender, forming a tubular extension, which reaches forward of the anterior face of the incisor, very similar to the conditions in *Reithroparamys* and *Sciuravus*. There seems to have been a deep notch between the nasals and the premaxillaries in lateral view. This resembles the condition in *Reithroparamys* and differs from that in *Sciuravus* and *Ischyrotomus* and in all the Santacrucian forms except perhaps in some species of *Sciamys* (Scott, 1905, pl. 66, fig. 10), where, however, it is merely suggested. No such condition is seen in *Acaremys* (*ibid.*, pl. 66, fig. 11; pl. 67, figs. 4, 10). Among Recent hystricomorphs, the anterior extension of the nasals is seen in *Echimys* and to a lesser extent in *Dasyprocta*, *Cuniculus*, and *Petromys*. For most of their length, the nasals are of nearly uniform width, seen from above, as in *Sciuravus*, *Ischyrotomus*, *Cuniculus*, and *Titanotheriomys*, and do not taper gradually caudad as in *Paramys*, *Ischyromys*, *Acaremys*, *Sciamys*, *Cavia*, *Chinchilla*, *Myocastor*, and *Echimys*, nor do they narrow mesially as in *Reithroparamys*. Each nasal ends posteriorly in a point at the middle of the bone, separated by a wedge of the frontals. Only *Sciamys latidens*, of all the Santacrucian forms (Scott, 1905, pl. 67, fig. 1), shows even a suggestion of this character. This separation is perhaps suggested in *Reithroparamys*, but in general in that form the posterior end of the nasals forms nearly a straight line, as is also the case in *Sciuravus*. In *Paramys*, conditions are similar to those in *Platypittamys*, but the wedge of the frontals is much narrower. *Lagidium* is the only living form that has been compared with *Platypittamys* in which such a condition is seen. The posterior margin of the nasals lies just behind the anterior margin of the dorsal root of the zygoma, as in *Acaremys*, *Reithroparamys*, *Paramys hians*, and *Ischyromys*, not reaching as far as in *Sciamys*, *Paramys delicatus*, *Ischyrotomus*, *Sciuravus*, or *Titanotheriomys*. The present form agrees essentially with most of the other Santacrucian forms in this respect. Among modern hystricomorphs, the situation is modified by the retreat of the dorsal root of the zygoma owing to the enlargement of the anterior deep masseter.

However, *Chinchilla* and *Hystrix* agree in this respect with *Platypittamys*, although the conditions in *Hystrix* are only superficially similar. The adjacent sutures are slightly doubtful, but it appears that the nasal extends well posteriad of the premaxilla and not quite so far as the maxilla. This condition, while unusual, occurs in *Cuniculus* and to a minor extent in *Stichomys* (Scott, 1905, pl. 65, fig. 16).

The premaxilla sends a long slender process towards the dorsum of the skull, which ends slightly in front of the anterior end of the zygoma (fig. 2A). The exact rearward end of the ascending process is uncertain, but appears certainly to have been anteriad of the posterior tip of the nasal, and to have been appreciably shorter than in *Reithroparamys*, but about as long, relative to the position of the zygoma, as in *Paramys* and *Cavia*. On the lateral surface (A.M.N.H. No. 29601) it has been impossible to locate the suture betwcen the premaxilla and the maxilla, and it has been drawn on the restoration about where it is in related forms.

The sutures bordering the frontal are very difficult to distinguish. However, it would appear that the frontal is fairly long, apparently being slightly longer than the parietal, as in *Paramys*, instead of being much longer, as in *Reithroparamys*. This would appear to be an agreement also with the other fossil and Recent hystricomorphs, except the erethizontids, in which the frontals are shorter than the parietals. Anteriorly, the frontals extend forward between the nasals, and the suture between the frontals can be traced clearly backward from here. At what is interpreted as the rear end of the bone, there appears to be a suture extending in a broad curve, posterolaterad from the median suture. The direction of this suture is similar to that in *Paramys*, but very different from conditions in *Reithroparamys*. This presumed suture reaches the lateral margin of the top of the skull shortly posteriad of the small postorbital process. This process appears rather similar to that in such Recent forms as *Lagostomus* or *Cuniculus* and such Santacrucian forms as *Steiromys*, *Neoreomys*, *Scleromys*, *Acaremys*, *Sciamys*, and *Perimys*. In view of its prevalence among the Santacrucian and Recent forms, as well as its presence in *Platypittamys*, it is quite possible that such a postorbital process is a primitive character among the South American hystricomorphs. No indication of such a process is seen in the Paramyidae, Sciuravidae, Ischyromyidae, Bathyergidae, *Hystrix*, *Thryonomys*, or *Petromys*. The postorbital process in the Sciuri-

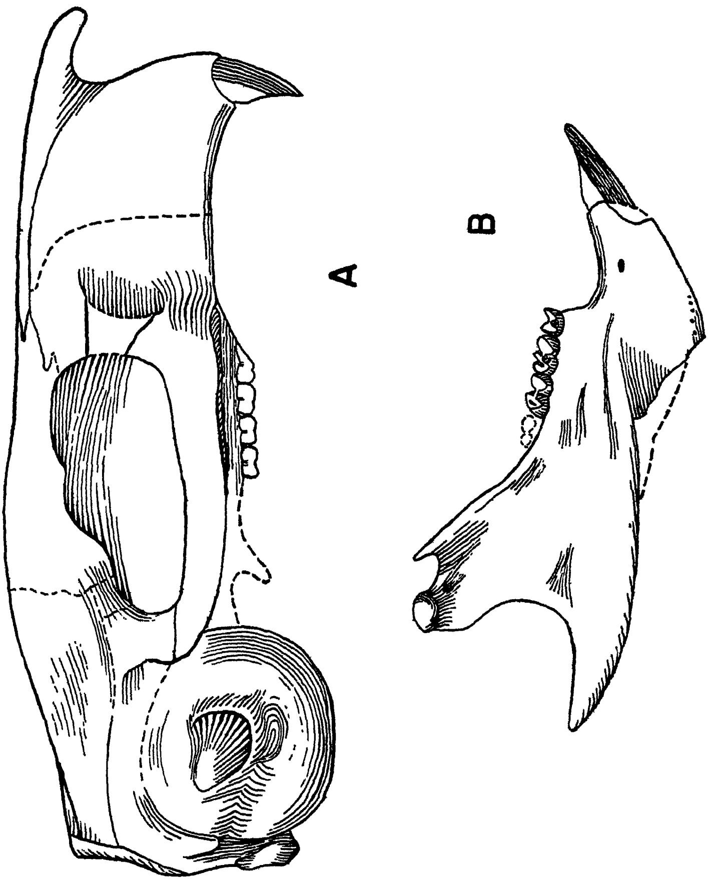

FIG. 2. *Platypittamys brachyodon.* A. Side view of skull, A.M.N.H. No. 29601. B. Lateral view, right jaw, A.M.N.H. No. 29601, with restorations based on lingual surface of jaw of A.M.N.H. No. 29600. Both × 3.

dae is very different in shape and relationships and is surely a parallel development. There is also a roof over the central part of the orbit, formed by the lateral edge of the frontal. The posterior end of this roof marks the point where the temporalis muscle passed to the dorsum of the skull. The extent of this passage is limited posteriorly by the glenoid fossa and shows that the muscle was quite small. The Santacrucian acaremyids and *Chinchilla* show the same conditions as does *Platypittamys*. In *Sciuravus*, *Paramys*, and *Reithroparamys*, conditions are very different, indicating a much larger temporalis. The dorsal surface of the frontals was probably nearly flat, with no indication of any frontal sinuses. Nothing can be told in regard to the extent of the frontal within the orbit since it is impossible to distinguish the cracks from the sutures in this area, and since most of it is not visible in either specimen.

The parietal shows no trace of a sagittal crest and appears to have been flat or gently curved in cross section. The posterior margin reaches the front of the weak lambdoid crest, and the lateral margin seems to reach about halfway to the lateral margin of the dorsum of the skull. Although it is impossible to be certain, it seems probable that the dorsal limit of the temporal fossa was near the lateral margin of the parietals. This again would indicate a much weaker temporalis than in *Sciuravus*, *Paramys*, or *Reithroparamys*, where it reached nearly or quite to the midline of the skull. Again, *Platypittamys* is very similar to *Acaremys* and *Sciamys* in this respect.

One of the few sutures that is clearly visible on the skull (A.M. N.H. No. 29600) is that bounding the interparietal (fig. 1). This is a fairly large bone, with a broad, triangular outline. In no other hystricomorphs does the bone appear to have any particular resemblance to that in the present form, though it appears to be unknown in *Acaremys* and *Sciamys*. It is rather larger and more triangular than in *Reithroparamys* and *Titanotheriomys*, but is rather similar in proportions to the interparietal of *Sciuravus* and *Ischyromys*, although it is somewhat smaller than that of *Sciuravus*.

The squamosal is badly damaged in both specimens, and its relationships are very questionable. There does not, however, appear to have been a temporal foramen as in the ischyromyids, paramyids, *Aplodontia*, and many other rodents. According to Scott's figures (1905), such a foramen is present in *Steiromys* and

Perimys but is absent in *Neoreomys, Sciamys, Schistomys,* and *Eocardia.* The squamosal laps around the bulla, to hold it in place, as in *Reithroparamys* and *Acaremys.* There is a fairly strong mastoid process at the rear of the bulla. The zygomatic process extends out as a narrow shelf above the glenoid fossa, with its anterior and posterior edges nearly parallel, instead of having the posterior face sloping anterolaterad as in paramyids and *Sciuravus.* This is associated with the enlargement of the bulla in *Platypittamys.*

The masseter apparently was limited to the ventral surface of the zygoma, as in paramyids, sciuravids, and *Ischyromys.* At least, if it had begun to grow up within the orbit, no trace of its presence can be found on the specimens, and it seems certain that it did not penetrate through the infraorbital foramen. This is a sharp distinction from *Acaremys* and *Sciamys,* where the typical hystricomorph conditions obtained. The compression of the skulls has made the determination of the exact size, shape, and position of the foramen somewhat questionable, but it seems to have occupied a position about as shown (fig. 2A), and to be somewhat larger and slightly higher on the face than in the protrogomorphs (paramyids, sciuravids, ischyromyids, etc.) and to be much smaller than in any other hystricomorphs. This material seems to establish that an enlargement of the infraorbital foramen definitely preceded the increase in the size of the masseter. The maxillary portion of the zygoma is fairly slender, but its position and alignment indicate that the zygoma arched quite widely from the skull as in *Acaremys, Sciamys, Paramys, Sciuravus, Ischyromys,* and most Recent South American hystricomorphs, instead of being essentially parallel to the skull as in *Reithroparamys, Hystrix, Thryonomys,* and *Petromys.* There is no suggestion of the forward migration of the zygoma, lateral to the infraorbital foramen, which is seen in the theridomyids. The suture between the maxillary and malar could not be identified. The malar forms the lateral limits of the glenoid fossa as in *Paramys, Reithroparamys,* ischyromyids, and many other rodents, including particularly the modern hystricomorphs.

The bulla is large and round, completely ossified, and firmly held into the rest of the skull. It extends considerably higher on the skull than in *Reithroparamys,* and is more globular. It is somewhat larger than in ischyromyids, but seems to be quite similar to that of *Acaremys* (Scott, 1905, pl. 67, fig. 9) and *Chin-*

chilla. The meatus, situated near the middle of the lateral surface, is large and directed posterodorsad. There is essentially no meatal tube, the meatus lying only slightly above the surface of the bone. There is a slight lip along the anterior side of the meatus, as in *Ischyromys*. These conditions are identical with those in *Reithroparamys* and seem to be only slightly more primitive than in *Acaremys*. A groove running just below the meatus divides the bulla into dorsal and ventral portions, ending just below the tip of the mastoid process. This seems to have been true also in *Acaremys*. The size of the bulla suggests an animal with an acute sense of hearing.

It is impossible to interpret the ventral surface of the skull. In A.M.N.H. No. 29600, the atlas, the right scapula, right mandible, right humerus, and some ribs are plastered over the palate so that it is impossible to recognize the relationships of any of the palatal bones. A.M.N.H. No. 29601 is flattened in such a manner that the palate is not visible. The occiput is also not visible in either specimen, but it appears to have been fairly broad and certainly was not inflated. The lambdoid crest was weak. The foramen magnum seems to have been a dorsoventrally compressed oval.

The mandible (fig. 2B) is long and slender with, apparently, at least a slight inflection of the angle, which extends well to the rear, below the bulla, as in *Trechomys*, *Cavia*, *Chinchilla*, *Coendu*, *Myocastor*, and *Thryonomys*, but quite different from what is seen in *Hystrix*. Owing to the flattening of both specimens, the amount of inflection cannot be established with certainty but appears to have been considerable. In lateral view the angle appears to have been very similar to that of *Erethizon*, the inflected portion of which is invisible laterally. In the paramyids there is no inflection, but the ventral border is thickened mesially. In ischyromyids there is a slight inflection of the angle. Since this area serves for the insertion of the pterygoideus internus (Howell, 1926, fig. 24c), it presumably means that the importance of this muscle had increased in *Platypittamys* when compared with paramyids or ischyromyids. As in both Santacrucian erethizontids and all Recent South American hystricomorphs, there is an expansion of the ascending process of the mandible immediately posteroventral to the condyle, not found in Hystricidae, *Petromys*, or *Thryonomys*. This seems to indicate an increase in the size of the pterygoideus externus over conditions in the para-

myids. The coronoid is quite small and separated from the condyle by a narrow furrow, being very different from what is seen in the paramyids, where the coronoid is large, but agreeing with later hystricomorphs. The mandible thus agrees with the skull in suggesting that the temporalis was small and weak. The masseteric fossa has no distinct upper limits, differing in this from *Tillomys* (Wilson, 1938, fig. 11), but its ventral margin is marked by a ridge which slopes forward and upward, leaving the ventral margin of the mandible about beneath M_3, and ending under the rear of P_4, about as in theridomyids. This ridge marks the abrupt lower limit of the fossa. The fossa appears to extend considerably farther forward and to be much less definitely bounded dorsally than in *Acaremys* and *Sciamys*. It also extends farther forward than in *Mysops*, where it ends beneath M_2 (Wilson, 1938, p. 208). In these respects, the present form is less like *Tillomys*, *Mysops*, *Reithroparamys*, and *Paramys* than are the later Acaremyidae, but all of them are rather distinct from the Eocene forms. This condition is interpreted as meaning that the masseter lateralis was beginning to spread out anteroposteriorly in *Platypittamys*, but that it was still relatively small. There is no tubercle for the anterior deep masseter, suggesting that it had not yet been differentiated. There is a small mental process of the mandible at the posterior end of the symphysis, rather similar to that in *Sciamys* (Scott, 1905, pl. 66, fig. 10), and larger than that of *Reithroparamys* or *Paramys*. There are a number of nutritive foramina in the extreme posteroventral portion of this process as in *Paramys*. These are not present in *Reithroparamys*. The mental foramen is fairly high on the mandible and at about the middle of the diastema. In this it agrees with *Reithroparamys*, ischyromyids, and with *Sciamys* and *Neoreomys*, and differs from the other Santacrucian rodents and from *Tillomys*, in which it is lower on the mandible. The symphyseal region is fairly large and is quite markedly corrugated, indicating a fairly firm union of the two mandibles. There presumably was no transversus mandibulae muscle. The pit for the geniohyal muscle is rather small and high on the mandible.

Dentition

The teeth are generally similar to those of *Asteromys* but differ in a number of ways, chiefly in being much lower crowned. The unilateral hypsodonty that characterizes *Asteromys* has begun

to be developed, but it has only just appeared. There are also some differences in the patterns of the teeth. As far as can be told from the available material of *Asteromys*, *Platypittamys* is structurally ancestral to it, and is sufficiently more primitive to warrant generic separation.

In distinction from the paramyids, sciuravids, and ischyromyids, there is no trace of P^3. This tooth, which is very small in those forms, is absent in most rodents, including all of the hystricomorphs.

P^4 is much simpler than in any other known hystricomorph (fig. 3A, B). It clearly is a long way from having attained a molariform pattern and is much less advanced than that of *Asteromys* (Wood and Patterson, in press). There is a considerable difference in the anteroposterior diameter of the tooth in the two specimens of *Platypittamys*. This tooth is elongate transversely, though the wear surface is not so wide as are the lower parts of the crown. There are an undivided buccal amphicone and a lingual protocone, connected by a crest. From the protocone, an anteroloph curves across nearly the entire front face of the tooth. From the posterior side of the protocone, a posteroloph extends around the posterior margin of the tooth. At its lingual margin this is somewhat thickened into what is probably not sufficiently advanced to be called a hypocone. This latter is separated from the protocone by a faint groove in the lingual face of the tooth. There is a similar slight swelling of the anteroloph, likewise separated from the protocone by a faint furrow. This tooth is extremely interesting. It appears to be in a very primitive stage of evolution. If its simplicity is indicative of primitiveness and not of secondary simplification, it is necessary to go far back towards the basic stock of the rodents to find a form that could be ancestral to this genus. No member of the Paramyidae whose upper teeth are known has so simple a P^4 as this. The Sciuravidae likewise do not show such a primitive pattern, the nearest approach to it being in *Mysops* (Wilson, 1938, fig. 5), where, however, the amphicone has divided and there is a clearly marked metaloph, considerably higher than the posteroloph. It is possible that P^4 of *Pauromys* was in this stage of development, but upper teeth of this form are unknown. There are no other forms with which I am familiar that have a P^4 anywhere near as simple as that of *Platypittamys*. Therefore, if the condition of this tooth is primitive, as it appears to be, no rodent whose upper

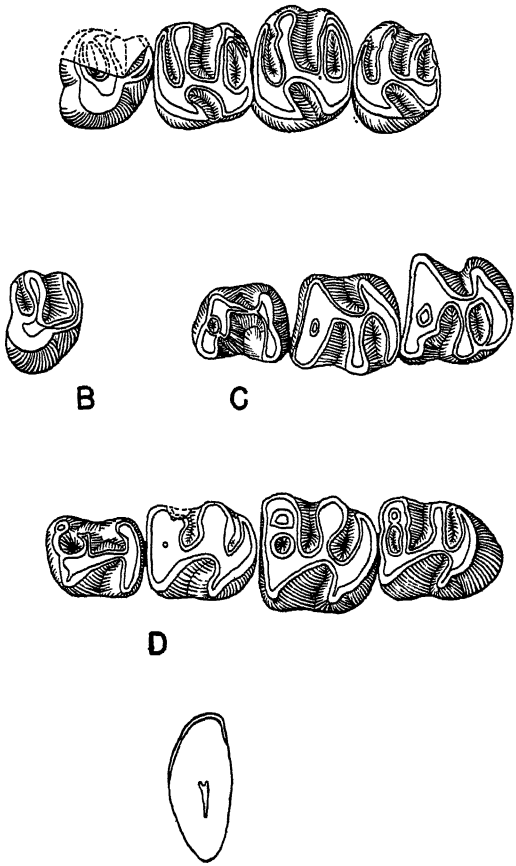

FIG. 3. *Platypittamys brachyodon*. A. LP^4–M^3, A.M.N.H. No. 29601, with P^4 restored from A.M.N.H. No. 29600. B. LP^4, A.M.N.H. No. 29600, anterior face to the right. C. LP_4–M_2, A.M.N.H. No. 29601. D. RP_4–M_3, A.M.N.H. No. 29600. E. RI^1, anterior view, A.M.N.H. No. 29601. F. RI_1, anterior view, A.M.N.H. No. 29601. All × 10.

dentition has been described could be ancestral to *Platypittamys*. On the basis of our general knowledge of paleogeography and of rodent paleontology, it would seem almost certain that this form could only be descended from a Paleocene or lower Eocene northern form. It is suggested that it may be closer to the Sciuravidae than to the Paramyidae, the only two families known from the lower Eocene. It should be pointed out that this is not the only case where P^4 of a middle Tertiary group does not seem capable

of being derived from that of any known Eocene rodent. The same is true of the heteromyids and geomyids (Wood, 1935, fig. 6; 1936, fig. 17).

Both upper and lower molars show fundamentally the same pattern as is found in the Ischyromyidae, namely, four transverse crests. The individual cusps, however, are not so distinct as in the ischyromyids. The upper molars are strikingly different from those of theridomyids in the absence of a mesoloph. In the lower teeth, however, the theridomyids likewise have four transverse crests (fig. 7).

M^1 (fig. 3A) is quite similar to that of *Asteromys* (Wood and Patterson, in press), differing in the lesser development of the lophs and the trace which still remains of the separate cusps in the protoloph and metaloph. The paracone is a distinct cuspule, which seems also to be the case in *Asteromys*, though it is smaller in that form. The metacone is very clearly marked as a round cusp. Both protoconule and metaconule seem to be indicated, although they are very faint, the teeth being apparently in transition to the uniform, lophate condition of *Asteromys*. The protoloph and metaloph are well developed and are connected by a mure, apparently representing the anterior arm of the hypocone. The anterior and posterior cingula bound the tooth, uniting with or coming close to the paracone and metacone. There is no trace of a mesostyle or a mesoloph. Indeed, none seems ever to be present in the South American hystricomorphs. This general idea has previously been expressed, with different wording, by Winge (1887, p. 128), who considered that the teeth of the ancestral South American hystricomorphs had four more or less complete transverse enamel folds. This point does not seem to have been stressed by subsequent authors. This basic tooth characteristic is a sharp distinction from the theridomyids (fig. 7) where the mesoloph is characteristically very well developed. Many figures of theridomyids suggest that there are only four transverse crests, but actually there are five in all forms, the valley between the anteroloph and protoloph being very shallow, so that it is quickly destroyed with wear. The figure of cf. *Phiomys andrewsi* from the lower Miocene of Southwest Africa (Stromer, 1926, pl. 42, fig. 24) also shows a mesoloph. Although, in general, none is present in the paramyids, there seems to be a tendency towards the development of such a crest in this family, whereas it is completely absent in *Mysops* and *Taxymys* (Wilson, 1938, figs. 5–9, 13–15).

As in *Asteromys*, M^2 is larger than M^1. This is in agreement with conditions in *Sciuravus*, but the reverse of the situation in *Mysops*. In general this tooth is very similar to M^1. Here again the paracone and metacone are quite clearly shown, and the conules appear to be indicated by slight swellings of the lophs. As in many other rodents in this stage of evolution, distinct conules are visible only on unworn or nearly unworn teeth. The protocone has grown back along the lingual face of the tooth, both in this tooth and in M^1, as in *Asteromys*, but it does not appear to have made as much progress in this direction as in the latter form. The separation of the protocone and hypocone is a distinct advance over the paramyids and some sciuravids, but these cusps are nearly as distinct in *Sciuravus* and *Taxymys* (Wilson, 1938). No trace of the posterior migration of the protocone is seen in sciuravids, and very little is shown by the theridomyids. This tooth is much more advanced than that of the Uintan ischyromid *Pareumys* (Burke, 1935, fig. 4), where the separation of the hypocone from the protocone has just begun.

TABLE 1

MEASUREMENTS (IN MILLIMETERS) OF UPPER TEETH

	A.M.N.H. No. 29601 Left	A.M.N.H. No. 29601 Right	A.M.N.H. No. 29600 Left
P^4			
Anteroposterior	—	1.20	0.95
Width anterior	—	—	*ca.* 1.33
Width posterior	—	—	*ca.* 1.31
M^1			
Anteroposterior	1.30	1.31	1.33
Width protoloph	1.41	—	—
Width metaloph	1.27	—	—
M^2			
Anteroposterior	1.30	1.33	—
Width protoloph	1.66	—	—
Width metaloph	1.49	—	—
M^3			
Anteroposterior	1.15	1.24	—
Width protoloph	1.49	1.51	—
Width metaloph	1.16	1.10	—
I^1			
Anteroposterior	—	1.93	—
Transverse	—	0.85	—

M^3 is similar to the two anterior molars but somewhat smaller (table 1), as in *Asteromys*, ischyromyids, and *Mysops*, instead of being of equal size, as in other sciuravids and paramyids. The protocone seems to form a larger part of the lingual surface of the tooth than in *Asteromys*. The posterior cingulum does not unite solidly with the metacone until after a fair amount of wear. The metacone is slightly farther to the rear than in the anterior molars, suggestive of the conditions in paramyids, but showing a trend towards the pattern of the anterior two molars.

P_4 is much the smallest of the lower teeth (fig. 3C, D) and is quite distinctive in its pattern. There are anterior and posterior crests, each formed of two cusps. These crests are united near the center of the tooth. In these respects this form is somewhat reminiscent of *Pareumys* (Burke, 1935, figs. 2–4). A short crest, perhaps an anterior cingulum, connects the metaconid and protoconid at the anterior end of the tooth. This is larger than in *Pareumys*. A spur from the protoconid extends towards the metaconid, damming off a small basin between it and the anterior cingulum. The free end of this spur is somewhat expanded into a small cuspule. The metaconid is slightly anteriad of the protoconid, also as in *Pareumys*. The ectolophid lies near, but not at, the center of the tooth, running slightly diagonally. There is a very faint expansion near its middle, which could not be called a mesoconid but suggests the initial stage in its development. The hypoconid and entoconid form a continuous wall along the posterior border of the tooth, with no indication that both hypolophid and posterolophid are present or ever were present. It is more suggestive of a hypolophid than of a posterolophid. In *Pareumys* both hypolophid and posterolophid are present. Except for *Pareumys*, this tooth is distinct from that of any other form with which it has been compared. On the one hand it is considerably simpler than the corresponding tooth of *Asteromys* (Ameghino, 1906, fig. 287), but could perhaps be the structural type from which the latter was derived. In *Asteromys* the talonid is approaching a molariform pattern, whereas in *Platypittamys* there is nothing suggestive of the molar pattern in the premolar. As in the case of the upper premolar, this tooth would seem clearly to establish the fact that no member of the Theridomyidae could possibly be ancestral to this form (fig. 7). The early members of the Paramyidae, some sciuravids (such as *Sciuravus* and *Pauromys*), or a form related to *Pareumys* could have given rise to a

tooth such as is present here, but they are all sufficiently distinct so that there is no evidence that they did. The movement of the ectolophid towards the middle of the tooth that characterizes *Platypittamys* has already gotten well under way in *Reithroparamys* and in sciuravids.

M_2 is the largest of the lower molars, with M_1 and M_3 subequal. Each tooth is composed of four cross crests, the metalophid and hypolophid together with the anterolophid and posterolophid. The anterolophid unites with the metaconid after very little wear, thus surrounding a lake in the trigonid. This is true of all the molars of both specimens. Although all teeth are somewhat worn, it appears that the metaconid is connected to the protoconid primarily through the anterior cingulum and only secondarily through a direct crest. This is also the situation in *Reithroparamys*, *Paramys*, *Mysops fraternus* (Wilson, 1938, fig. 9), and in *Pareumys*. In addition *Platypittamys* agrees with these forms in the shortness of the metalophulid II. At least sometimes, a secondary bar connects the two crests through the trigonid basin, forming two small lakes (fig. 3D). M_2 seems somewhat more advanced than M_1, in that the union of the two posterior crests has occurred on that tooth in A.M.N.H. No. 29601, whereas they are still separate on M_1. The hypolophulid I unites with the ectolophid, the entoconid being anterior to the hypoconid. The posterolophid is as large as the hypolophulid, but shows no trace of separate cusps. The central valley of all three molars opens widely on the lingual side, the valley draining freely, in contradistinction to *Asteromys*, where all the lingual valleys are closed by dams, and where the connection between the posterolophid and the entoconid appears weaker than that between the entoconid and the metaconid (Ameghino, 1906, fig. 287).

The incisors are laterally compressed, their transverse diameter being much less than their anteroposterior one (fig. 3E, F). This does not appear to be more than a generic character, there being great variation in this condition in many groups of rodents. In the paramyids, compressed incisors occur in *Reithroparamys*, and wide ones in most other genera. Among the theridomyids, *Trechomys* has compressed incisors, whereas in the more primitive *Theridomys* they are in the form of equilateral triangles. In *Sciamys* they are compressed; in *Acaremys*, broad and convex.

The upper incisors (fig. 3E) are slender and seem to have been

TABLE 2

MEASUREMENTS (IN MILLIMETERS) OF LOWER TEETH

	A.M.N.H. No. 29601 Right	A.M.N.H. No. 29600 Right	Left
P_4–M_3	—	6.20	6.36
P_4			
Anteroposterior	1.23	1.24	1.25
Width metalophid	0.93	—	*ca.* 1.06
Width hypolophid	1.02	—	*ca.* 1.03
M_1			
Anteroposterior	1 46	1.49	1.46
Width metalophid	1 23	—	*ca.* 1.21
Width hypolophid	1.34	—	*ca.* 1.29
M_2			
Anteroposterior	1 47	1.48	1 53
Width metalophid	1.43	—	*ca.* 1.54
Width hypolophid	1.41	—	*ca.* 1 52
M_3			
Anteroposterior	—	1.70	1.64
Width metalophid	—	—	*ca.* 1.33
Width hypolophid	—	—	*ca.* 1.28
I_1			
Anteroposterior	1.72	—	1 55
Transverse	0 68	—	0.88

nearly oval in cross section, as in *Reithroparamys.* The median face is flat, and the lateral face rounded, the diameter tapering both anteriorly and posteriorly. There was a very faint groove on the anterior face, just laterad of the middle of the tooth, similar to that in *Reithroparamys*, but too small to show on the figures. The pulp cavity is elongate and narrow, with a suggestion of an anterior expansion. The enamel is exceedingly thin and apparently extends from the middle of the lateral side, well around the anterior face onto the median surface, about as in *Reithroparamys*. The exact limits of the enamel-covered area are uncertain.

The lower incisors are somewhat more clearly preserved than the uppers (fig. 3F). The lateral and mesial sides are more nearly parallel than in the upper incisors. The essential relationships appear to be about as indicated for the uppers, with the enamel reaching about halfway around the lateral face of the tooth and almost a third of the way along the median surface. The anterior face of the lower incisors is slightly flatter than in the uppers,

and there is no trace of a sulcus. The pulp cavity is long and narrow, being almost a straight line. In all these respects the similarities to *Sciamys* and *Reithroparamys* are marked.

Postcranial Skeleton

Although all three specimens are fairly complete and contain a considerable number of vertebrae, it is not possible to determine the vertebral formula with certainty. There were presumably seven cervicals. Probably there were 13 thoracic vertebrae, of which the ninth is the anticlinal, and six lumbars. There seem to have been one sacral and two pseudosacrals and about 25 caudal vertebrae. These figures are approximately the same as those in Scott's figure of *Neoreomys* (Scott, 1905, pl. 70), which, in turn, is restored, using *Myocastor* as a guide. These figures also agree with the vertebral formula of *Aplodontia* and differ from that of *Ischyromys*, *Sciurus*, *Cynomys*, or *Paramys* in having one more thoracic and one fewer lumbar vertebrae than these forms (Wood, 1937, p. 179). The presence of 19 thoracic and lumbar vertebrae seems to be widespread among the rodents (Flower, 1876, p. 50) and is presumably primitive for rodents. The tail is apparently somewhat shorter than in most of these forms, but was nearly half the length of the entire vertebral column.

Most of the cervicals are covered by other bones or are in part squeezed into them. The neck, however, seems to have been rather shorter than in *Paramys* or *Ischyromys* and definitely shorter than in *Neoreomys*. The atlas lies immediately beneath the occiput in A.M.N.H. No. 29600 and shows the ventral surface. It is broad transversely and short anteroposteriorly, with little or no hypopophysis. The vertebrarterial foramen is small as in *Cynomys*, instead of being large as in *Ischyromys*. The transverse processes extend forward, reaching anteriad of the lateral surfaces of the occipital condyles but do not appear to have extended behind the main part of the atlas. In these respects the bone is completely different from that of *Ischyromys*. They are larger anteroposteriorly than in *Paramys*. The other cervicals are not visible.

The thoracic vertebrae increase in size from front to rear, and this increase continues about to the fourth lumbar as in *Paramys*. The spines of the anterior thoracic vertebrae were not very long, being completely covered by the scapula in A.M.N.H. No. 29600.

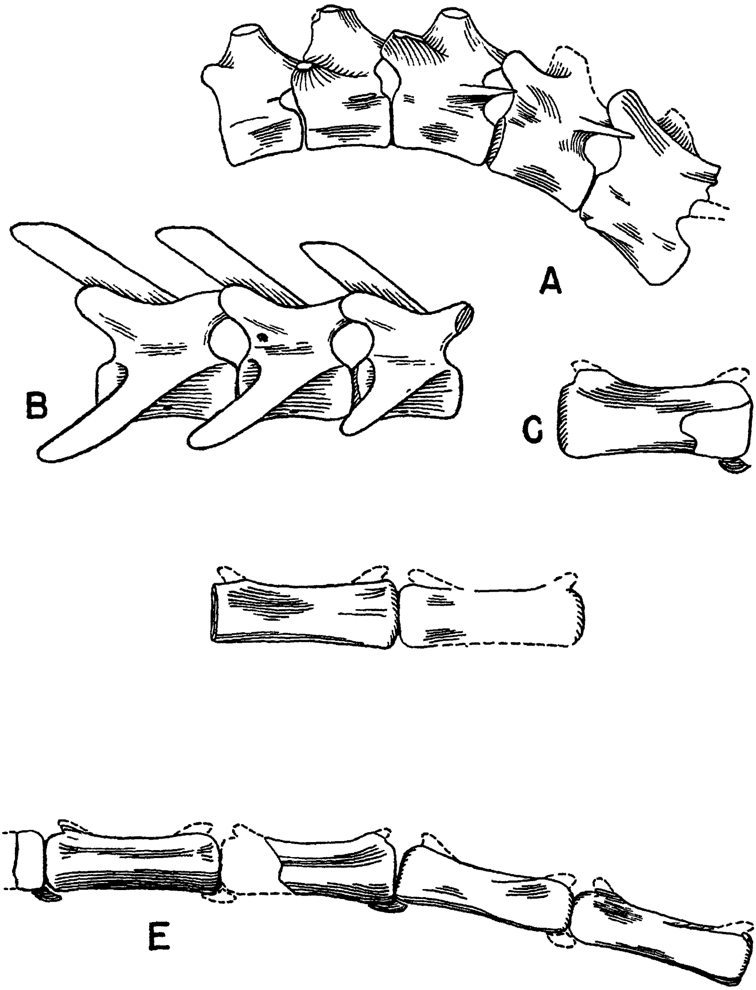

FIG. 4. *Platypittamys brachyodon*. A. Left side of ninth to thirteenth thoracic vertebrae, A.M.N.H. No. 29600. B. Left side of the fourth to sixth lumbar vertebrae, A.M.N.H. No. 29600, partially restored. C. Right side of eighth (?) caudal vertebra, A.M.N.H. No. 29602. D. Right side of tenth (?) and eleventh (?) caudal vertebrae, A.M.N.H. No. 29602. E. Right side of twelfth (?) to fifteenth (?) caudal vertebrae, A.M.N.H. No. 29602. All × 3.

They appear to have been shorter than in *Sciamys*. The ninth to thirteenth thoracic vertebrae are visible. The spines are short, and all behind the ninth slope slightly anteriad. The bones as

preserved form an arch, which is probably the natural position (fig. 4A). The diapophyses are not distinguishable, nor are the facets for the heads of the ribs. The metapophyses progressively increase in size caudad. Large anapophyses are present on the last three thoracics, and a small one is present on the tenth. There is a suggestion on the last thoracic of a small diapophysis, although there seems to have been a rib for this vertebra.

The lumbar vertebrae are fairly large, with long, forwardly directed neural spines, which reach as far as the middle of the vertebra in front, and long diapophyses (fig. 4B). The latter decrease in length on the last two lumbar vertebrae. The neural spines are longer than in *Neoreomys*, which otherwise appears to have been rather similar, and are very much longer than in the paramyids and ischyromyids. A very similar condition in regard to the length of the neural spines and diapophyses occurs in all saltatorial rodents (Hatt, 1932, p. 673) and is foreshadowed in the subricochetal *Cupidinimus* (Wood, 1935, p. 130, fig. 50). Median ventral foramina appear in the centra as in *Paramys*, *Dipodomys*, and *Microdipodops*, which are absent in *Cupidinimus*. As in *Paramys*, there appears to be no trace of the keeling on the ventral surface of the lumbars which is seen in *Ischyromys*. As in *Paramys* and *Neoreomys*, the metapophyses do not rise appreciably above the prezygapophyses. The most significant feature of the lumbars is the length of the neural spines and diapophyses. As pointed out by Hatt (1932, p. 673), the increase in the length of the neural spines of richochetal forms is correlated with an increase in the size "of the *Mm. multifidus spinae* which support the fore end of the body during bipedal progression." They also serve for the insertion of the pars lumborum of the semispinalis, which is also used to hold up the front end of the animal in leaping (Howell, 1932, pp. 426–428). The long diapophyses are also characteristic of ricochetal forms but occur as well in quadrupedal leapers and cursorial forms. These are related to the longissimus dorsi, quadratus lumborum, and psoas major muscles (Hatt, 1932, p. 684).

The sacrum preserved in A.M.N.H. No. 29600 apparently consists of a single sacral vertebra and two pseudosacrals. The transverse processes of the sacral and first pseudosacral are fused, an advance over the situation in *Paramys* where the fusion is incomplete, and the processes of the sacral extend forward on each side of the last lumbar, as far as its middle. These are longer

than in *Paramys*. Only the single sacral seems to have articulated with the ilium, as in *Paramys*. This is more primitive than the condition in *Sciamys*, where there are two sacrals articulating with the ilium and two pseudosacrals (Scott, 1905, pp. 422–423).

The anterior portion of the caudal series is preserved in A.M.N.H. No. 29602. These seem to represent the first five caudals. The first four bones are of almost uniform size, and the fifth is appreciably longer. There are median ventral foramina. The transverse processes are massive, anteroposteriorly expanded, and are nearly continuous for the entire length of the centra. In *Paramys* this is true of the first two caudals, which lie within the basket of the pelvis, but does not characterize the more posterior ones. This expansion of the transverse processes indicates fairly large extrinsic tail muscles, of the sort found in *Pedetes* (Hatt, 1932, p. 685) and quite different from the conditions found in all slender-tailed rodents. There is no suggestion of the large, elongated, transverse processes found in *Erethizon*. The similarities to *Myocastor* (Scott, 1905, pl. 70) seem to be very striking, particularly when it is realized that two additional caudals have moved into the pseudosacral region in the modern genus. The processes are wider and considerably shorter than those of *Paramys delicatus*. That is, there must have been muscles passing into the anterior portion of the tail of *Platypittamys*, but they were not so heavy as in the porcupine, beaver, or *Paramys*.

The posterior caudals seem to be nearly uniform rods (fig. 4D, E). There is still an appreciable, though interrupted, neural arch on what seems to be the eighth caudal, but behind this the vertebrae are essentially block shaped with a slight median constriction closely resembling those of *Myocastor*. There is no indication of the marked hourglass constriction seen in *Paramys delicatus*. The chevrons, which are preserved only in the posterior caudals, appear not to be paired but to be shaped like spherical triangles, filling the spaces between the vertebrae and resting on the anterior end of the posterior of each pair of vertebrae. They show considerable similarity to those of small-tailed ricochetal rodents and of *Myocastor* and are quite different from those of such fleshy-tailed rodents as *Pedetes*.

The lumbar vertebrae, then, show interesting similarities in structure to what is seen in ricochetal rodents, but these similarities are not found in the rest of the skeleton. This is interpreted

as meaning that *Platypittamys* possessed strong back muscles, probably used to assist the animal in sitting up on its haunches. The structure of the caudal vertebrae indicates a slender tail, with muscles extending only into the proximal portion and with the distal part largely tendinous.

There seem to have been 13 ribs, increasing gradually in size to the ninth or tenth, after which they are progressively shorter. In all cases where they could be studied, the tuberosities are quite low and poorly marked, and the neck is but little, if any, constricted.

The scapula is considerably more elongate than is that of *Erethizon*, having a long, slender, tapering neck region (fig. 5A), about as in *Neoreomys*. The posterior side is essentially straight, whereas the cranial border curves somewhat anteriad, though it does not have the pronounced cranial expansion of that of *Myocastor* or *Neoreomys* (Scott, 1905, pl. 70), being more like that of *Ischyromys*, *Echimys*, or *Thryonomys* in this respect. The dorsal borders of both scapulae of A.M.N.H. No. 29600 are too broken to permit adequate discussion. The central half of the spine appears to have been quite high, indicating fairly large supraspinous and infraspinous muscles. Ventrally, the spine ends well up on the side of the scapula, being continued in a long, slender, acromion process, which extends well beyond the glenoid fossa. The scapular notch is nearly a third of the way up the spine, but the spine is continued almost to the glenoid as a faint ridge. These features are very different from what is found in paramyids and ischyromyids and suggest the conditions in *Neoreomys*, *Chinchilla*, *Myocastor*, *Echimys*, and *Kannabateomys* or, to a lesser degree, *Dasyprocta*, *Coendu*, *Georychus*, *Petromys*, or *Thryonomys*. There is a small metacromion process, considerably smaller than that of any of the living hystricomorphs. The details of the glenoid region cannot be determined.

The left clavicle is preserved in A.M.N.H. No. 29600 and shows very few diagnostic features. It is long and slender and only slightly curved. The two ends are but slightly expanded.

The humerus is represented only in A.M.N.H. No. 29600, by a nearly complete left humerus and a fragmentary right one (fig. 5B). Only the lateral surface is visible. It appears to be unusually thick for its length, but partly, at least, this is due to crushing, as may be told by comparison with the humerus of *Paramys*, to which this is quite similar. Particularly, the deltoid crest seems

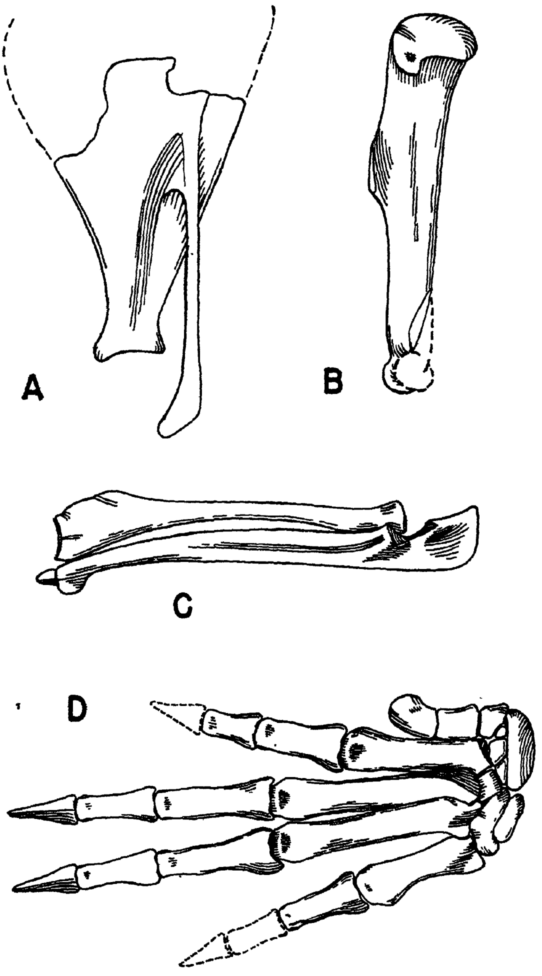

FIG. 5. *Platypittamys brachyodon*. A. Lateral surface of left scapula A.M.N.H. No. 29600, with restorations based on right scapula. × 3. B. Lateral view of left humerus, A.M.N.H. No. 29600. × 3. C. Lateral oblique view of left radius and ulna, A.M.N.H. No. 29600. × 3. D. Dorsal view of left manus, A.M.N.H. No. 29600, with assistance from right manus and from A.M.N.H. No. 29601. × 6. Dotted bones purely hypothetical.

to have been squeezed laterally so that it lies in the plane of the lateral margin of the bone. But even so the bone seems to have been proportionately quite stout. The head is less globular than that of *Paramys* or *Ischyromys*, not extending so far down the posterior face of the bone, indicating less freedom of movement at the shoulder. The greater tuberosity is large and is separated by a shallow groove from the head, as in *Paramys* and *Ischyromys*. On the lateral surface there is a pronounced notch between the tuberosity and the head, which is only slightly indicated in *Paramys* or *Neotoma* but which is equally well developed in *Ischyromys*. The deltoid crest has a broad outer surface, which seems to have risen to a uniform height for about 2 mm., more suggestive of conditions in cricetids than in paramyids or *Ischyromys*, and which is perhaps somewhat suggestive of *Theridomys*. Proximally the crest tapers gradually towards the greater tuberosity as in *Paramys*, but there appears to have been a more distinct deltoid process. Distally there is a considerably more abrupt termination of the process than in *Paramys* where it tapers gradually into the shaft. There appears to have been a considerable thickening of the top of the crest, only slightly suggested in *Paramys*. In all these respects, this form differs even more from *Neoreomys* (Scott, 1905, pl. 70) and *Ischyromys* than from *Paramys*. The ectepicondylar ridge is broken, but it appears to have formed a wide flange, curving down to the ectepicondyle as in *Paramys*. The capitulum is broken off, but the median half of the distal end is preserved. There is a deep supratrochlear fossa on the anterior face of the bone, just proximal of the condyle, perhaps even larger than in *Ischyromys*. Although this bone is somewhat broken here, this fossa is unquestionably very deep and seems to have penetrated all the way through the bone, as in *Sciamys*, *Neoreomys*, *Trechomys*, and *Theridomys*. There is an entepicondylar foramen as in *Trechomys* and *Theridomys*, though it seems to have been quite small, as in *Paramys*, *Ischyromys*, and *Sciamys*. It is absent in *Neoreomys*.

At least parts of both ulnas are present in A.M.N.H. Nos. 29600 and 29601. The only complete one is the right ulna of No. 29601, though two of the others are nearly complete. Unfortunately all three of the more complete bones are so preserved as to show only the median side. The shaft tapers very little distally, even less than is shown in figure 5C, in which the bone is slightly twisted so as to expose its narrow face. The shaft is

slightly bent as in *Ischyromys*, but without the sigmoid curve as in *Paramys*. Distally the ulna makes up about a third of the carpal articulation, as in *Paramys* and *Reithroparamys*. There is no suggestion of the distal flaring of the ulna seen in *Ischyromys*. The general appearance of the bone is rather similar to that of *Neotoma*. The olecranon is large, and the top is expanded at its free end, curving up towards the humerus, increasing the leverage of the triceps. This feature has not been seen in any of the forms with which these specimens have been compared except in *Ischyromys*. There is a deep tricipital fossa, on the main part of the olecranon, as in *Neoreomys*. It is deeper than that in *Paramys* but not so rugose. The coronoid process slopes off fairly gently into the shaft, as in *Paramys*, presumably serving as the origin of the flexor digitorum sublimis. Just distad of the coronoid is a deep fossa with an overhanging ventral margin, marking the insertion of the brachialis, also very pronounced in *Paramys* and *Ischyromys*. This fossa continues distally as a shallow groove running most of the length of the bone, whereas in *Paramys* it is quite short. In *Ischyromys* it runs about a third the length of the ulna. Distally there is no indication in any of the available material of a fossa for the pronatus quadratus, which seems to have been very strong in *Paramys* and *Reithroparamys*. This may be due to the positions of the bones as preserved in *Platypittamys*, but more probably indicates that this animal was beginning to be limited to fore-and-aft motion of the forearm. The styloid process is fairly large.

The shaft of the radius is somewhat more curved than is that of the ulna. As in *Reithroparamys* and *Ischyromys*, the radius is considerably larger distally than the ulna, being especially wide just proximad of the distal end, where there is a marked lateral expansion presumably fitting close against the ulna. The bicipital tuberosity is fairly prominent. The head seems to have been transversely elongate, as in *Ischyromys* and *Paramys*.

The manus is preserved on both sides of the holotype. In A.M.N.H. No. 29601, one manus is preserved showing the ventral surface, largely concealed by sesamoids, and the other is completely flattened and obscured by other bones. The manus is pentadactyl (fig. 5D), with the thumb considerably reduced in size but apparently still functional. The whole first digit is longer than metacarpal V, but shorter than metacarpals II, III, and IV. The third and fourth digits are the longest and are

about the same size, with the second and fifth shorter and subequal. This suggests artiodactylate trends and is probably a cursorial adaptation. It is very suggestive of the arrangement in *Chinchilla*, *Dolichotis*, and *Myocastor* and is a marked contrast to *Sciamys*, where, according to Scott (1905, p. 423), the second and third metacarpals are subequal and the fourth is shorter. The manus is about half the length of the pes as in *Paramys*, *Reithroparamys*, *Marmota*, and *Erethizon*.

The scapholunar is large, extending across the entire radial surface. It is convex proximally to fit the radius and is slightly concave distally. As in *Reithroparamys*, there is no suggestion of any separation into scaphoid and lunar. In this respect *Platypittamys* agrees with most rodents and is more advanced than *Paramys*, *Ischyrotomus*, or *Ctenodactylus*. At the median side there is what seems to be a very large and elongate radial sesamoid, as large as the pisiform would be expected to be, and apparently much larger than it was in this particular animal, since the pisiform has not been certainly identified.

The cuneiform is very much smaller than the scapholunar and seems to have been placed somewhat diagonally, with its lateral margin farther distad than the mesial margin, fitting against the styloid process of the ulna. In life it must have been in contact with the scapholunar. This bone resembles that of *Reithroparamys* in its general shape, but differs from that both of that genus and of *Paramys* and *Ischyrotomus* in being very much smaller.

There was a rather large centrale, triangular in shape, with its base fitting against the scapholunar. The trapezium is a fairly large bone, supporting the pollex. It is convex proximally, where it fits against the scapholunar. Probably in life there was only a small area of this bone visible, and the reconstruction of the manus has been made in this manner. It abutted against the broad mesial face of the trapezoid.

The trapezoid has the shape of a trapezium, its proximal and distal faces being essentially parallel. The mesial slope is nearly at right angles to this, fitting against the trapezium. Laterally the slope is much more oblique, running from the short distal face to the long proximal one and ending almost at the lateral margin of the scapholunar. Its surface exposure is much greater than is that of *Reithroparamys*.

The magnum is essentially square or diamond shaped, with one of the angles directed proximally, wedged between the trapezoid

and unciform, and nearly, but not quite, reaching the scapholunar, being separated from it by the centrale. The two distal facets of the bone articulate with the second and third metacarpals. Its relationships are about as in *Reithroparamys*, *Myocastor*, and *Chinchilla*.

The unciform shares with the scapholunar the position of largest bone in the manus. It is an irregularly shaped bone, concave proximally and convex distally when viewed from the dorsal surface, although the proximal surface itself is convex. A long process extends proximo-mesially and makes contact with the lateral corner of the scapholunar. The cuneiform fits against its proximal surface. The general shape and relationships of the unciform appear to be about as in *Reithroparamys*, *Myocastor*, and *Chinchilla*, and quite different from what is found in *Paramys* and *Ischyrotomus*, where it is more rectangular. In *Platypittamys*, however, the unciform is considerably larger than in *Reithroparamys*.

Metacarpal I is very short, being actually shorter than either of the phalanges. Although the digit is unknown in *Reithroparamys*, it seems to have been more slender in that form, apparently undergoing a different type of reduction. The ungual phalanx of the pollex is broad distally and appears to have borne a hoof-like claw. This digit appears to have been slightly divergent but certainly was not opposable. The other four metacarpals expand distally, having quite slender shafts. The fifth is somewhat divergent on the best-preserved hand, but this was probably not true in life, and the manus is restored with a greater parallelism of the digits than was the case in any of the paramyids. All the ungual phalanges appear to be somewhat broadened and to have carried hooflets rather than claws. This was also true of *Sciamys* (Scott, 1905, p. 424).

Parts of both pelves are preserved in the holotype, and part of the right pelvis in A.M.N.H. No. 29601. The pelvis is long and slender (fig. 6A), as in *Sciamys*, being much less massive than in *Neoreomys* (Scott, 1905, pl. 70) and showing essentially no similarities to that of *Ischyromys*. The ilium is definitely trihedral, with a prominent external crest which, as in *Neoreomys* and *Paramys*, is far down towards the ventral side of the bone, although it is not so low as in *Hystrix* and erethizontids. The superior gluteal fossa is considerably larger than the inferior and is a broad, gently basined surface. The tubercle is a large, oval

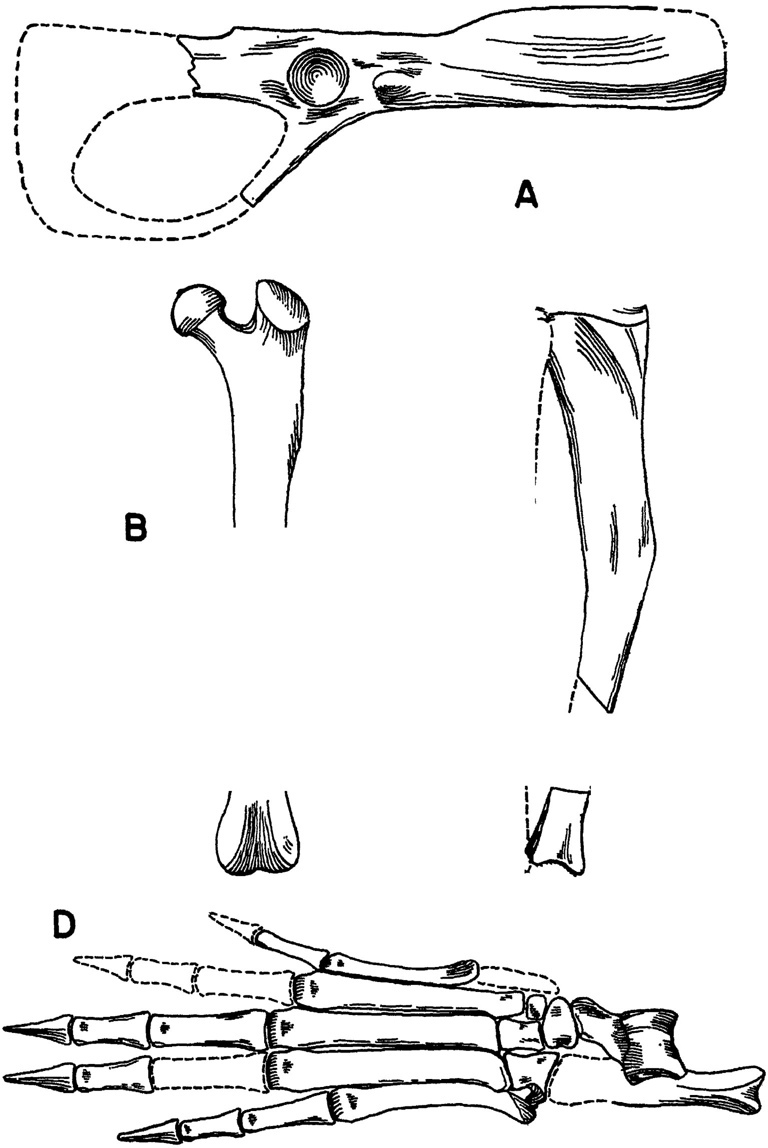

FIG. 6. *Platypittamys brachyodon*. A. Lateral view of right pelvis, A.M.N.H. No. 29600, with some additions from left pelvis. B. Anterior view of left femur, A.M.N.H. No. 29600. C. Mesial view of left tibia and fibula, A.M.N.H. No. 29600, with additions from right tibia. D. Dorsal view of left pes, A.M.N.H. No. 29601, with assistance from right pes and from A.M.N.H. No. 29602. Dotted outlines purely hypothetical. All × 3.

prominence, slightly below the line of the posterior end of the gluteal crest, as in *Paramys* and *Cavia*, instead of being a continuation of it as in *Neoreomys*, *Chinchilla*, *Myocastor*, and *Dasyprocta*. The tubercle ends posteriorly in a rounded curve as in *Cavia*, *Chinchilla*, *Dasyprocta*, and *Myocaster*, not being continued posteriorly towards the acetabulum. In *Paramys* the tubercle grades into the anterior margin of the acetabulum as in erethizontids. The ligament of the rectus femoris had a broad origin over the entire surface of the tubercle as in *Paramys*. The ilium was attached with its long axis essentially parallel to the vertebral column, again as in *Paramys*. This, plus the length of the ilium, gave a strong anteroposterior component to the pull of the rectus femoris anticus and the tensor fasciae latae. The notch marking the posterior end of the sacral articulation is well forward of the tubercle as in *Cavia*, *Chinchilla*, *Myocastor*, and *Dasyprocta*, instead of being just in front of it as in *Paramys* and *Hystrix*, or above it as in *Neoreomys* and erethizontids. This does not indicate a proportionately weaker articulation but rather results from the proportionately greater length of the ilium. The ventral border of the acetabulum is concealed by the femur in both specimens, so that it may not be complete in this area. As far as is visible, however, it is complete. The main axis of the ilium is continued in the ischium, of which only the anterior part is preserved. There is a small but pronounced sciatic notch, which is completely absent in *Neoreomys*, *Sciamys*, *Chinchilla*, *Myocastor*, and *Dasyprocta*, but is present in *Paramys*, *Cavia*, *Echimys*, and the erethizontics. The anterior part of the pubis is preserved, sloping posteroventrad, whereas in *Paramys* there is little or no posterior slope. The anterior end of the obturator foramen is sharply rounded, like the small end of an egg. While the ilium is thus rather similar to that of *Paramys*, the posterior part of the pelvis differs from it in almost every respect. Unfortunately the pelvis of *Reithroparamys* is unknown. There are no very close similarities to the pelves of living hystricomorphs.

Both femora are preserved in the holotype, and the distal ends are present in A.M.N.H. No. 29601. They are, of course, flattened so that the width is considerably distorted, and it is impossible to prepare them so that all parts can be seen. Most of the bone, however, can be studied. The femur has an over-all length of about 26.5 mm., about 50 per cent longer than the humerus, and appears to have been essentially straight. The

greater trochanter extends slightly proximad of the head as in *Reithroparamys*, *Paramys*, and *Ischyromys* (fig. 6B). The head is at right angles to the neck as in paramyids and the Santacrucian hystricomorphs. The neck is at an angle of about 45° with the long axis of the bone, also as in paramyids. None of the available material shows the lesser trochanter or the trochanteric fossa. The femur appears to be of uniform width throughout, as is that of *Reithroparamys*, of *Paramys*, and of *Ischyromys*. The third trochanter may have been absent, but probably there was a very minute one, a notable distinction from *Reithroparamys*, where it is fairly large, or from *Paramys* and *Trechomys*, where it is both large and far down the shaft of the femur. In the small size of the third trochanter, *Platypittamys* anticipates *Eocardia*, *Schistomys*, *Prodolichotis*, and *Sciamys* of the Santacrucian (Scott, 1905), and *Parapedetes* (Stromer, 1926), where it is absent. Distally the two condyles appear to extend equally far, although this region is considerably damaged in all the available material. In the paramyids the medial condyle extends somewhat distad of the lateral. There is a deep patellar groove, and the patella is a narrow oval, like that of *Ischyromys* and *Paramys*.

Parts of the tibia and fibula are preserved from both sides of the holotype. They are all damaged distally, so that the exact length cannot be determined. The tibia, however, was at least 26 mm. long and probably a little longer. The tibia and fibula were separate throughout their entire length (fig. 6C) and appear to have been somewhat more divergent than in *Sciamys* (Scott, 1905, pl. 67, fig. 2) or *Neoreomys* (*ibid.*, pl. 70), and less so than in *Titanotheriomys*, resembling *Paramys* and *Reithroparamys* in this respect. There is no trace of the close appression of the two bones seen in *Sciamys*. The cnemial crest of the tibia was strong and forms a pronounced prominence about the middle of the shaft of the tibia. There seems to have been a slight mesial overhang of the crest. The posterior face of the tibia is arched. In all these respects the bone shows great similarities to that of *Reithroparamys* and of *Titanotheriomys*. The tibia of *Paramys* differs chiefly in that the cnemial crest is not pronounced and has no overhang. The distal end of the tibia does not seem to have been so deeply grooved as in *Paramys*, being more similar to that of *Reithroparamys* in this respect. This is, of course, related to the smaller size of the astragalar keels. The distal part of the fibula is round in cross section, and the proximal part is

oval, about as in *Reithroparamys*. The bone seems to have been nearly straight, in contrast to the bowing of the tibia, again suggesting conditions in *Reithroparamys*. The head of the fibula does not seem to have been so expanded as in *Paramys*, *Reithroparamys*, and *Titanotheriomys*.

The pes is long and markedly compressed, with all the digits essentially parallel (fig. 6D). Like the manus, it seems to indicate a much greater amount of cursorial adaptation than is seen in the paramyids. As in the manus, there are some artiodactylate tendencies, with the axis of the foot passing between the third and fourth digits, which are of equal size. The second and fifth are also of about equal size, while the hallux is both shorter and more slender. The closest similarities to this foot shape that have been noted in Recent hystricomorphs are in *Chinchilla*. There are numerous similarities to the pes of *Parapedetes* (Stromer, 1926, pl. 42, fig. 11), except for the absence of the hallux in the latter, but they are probably in part retention of primitive features and in part similar adaptations. In many details the two are widely different, and there is no suggestion of close relationship.

The astragalus is preserved in all three specimens, but it is clearly shown only in A.M.N.H. No. 29602. The two keels are of nearly equal length, the lateral being only slightly longer than the mesial. They are aligned parallel to the long axis of the foot. In these respects the bone resembles that of *Sciamys* and of *Lagostomus*, *Dolichotis*, and *Coendu* among Recent hystricomorphs. It differs from the astragalus of *Paramys*, *Reithroparamys*, and *Ischyromys*, as well as from that of *Neoreomys*, *Dasyprocta*, *Hystrix*, *Thryonomys*, and many other hystricomorphs, in which the lateral keel is considerably longer than the mesial, and the axes of the keels are at an appreciable angle to the axis of the pes. In *Cuniculus* and *Parapedetes* the axes are parallel to the long axis of the foot, but the lateral keel is much longer than the mesial. As in *Riethroparamys*, the keels are distinctly lower than those of *Paramys*. The neck is inclined sharply mesiad, so that the center of the head is in line with the mesial keel as in *Paramys*, *Reithroparamys*, *Dolichotis*, *Myocastor*, and *Coendu*, in contradistinction to conditions in *Sciamys* and *Parapedetes* and many other hystricomorphs. The neck is fairly wide and, distally, expands mesiad. The navicular facet extends nearly straight across the width of the head but, when viewed from either the dorsal or ventral aspects, does not extend onto the median side of the bone as in

Sciamys. Unfortunately it is impossible to free the bone completely from the matrix, but it seems probable that the articulation was only distal. In this, *Platypittamys* differs markedly from *Paramys* and *Reithroparamys*, where the distal end of the astragalus is curved, with the facet extending the entire width, or from *Neoreomys* and *Erethizon*, where the articular surface continues onto the mesial side. There is no suggestion of the mesial sesamoids in this region that characterize the erethizontids. The mesiad direction of the neck is, however, very similar to conditions in all of these genera and is quite different from its more anteroposterior direction in many Recent South American forms, such as *Dasyprocta*, *Lagostomus*, and *Cuniculus*. The plantar surface is more like conditions in *Reithroparamys* and *Titanotheriomys* than in any other forms with which it has been compared. The ectal facet is elongate and, if projected onto a plane, would be a flattened hexagon, with long medial and lateral faces. This hexagonal shape is rather different from that in *Paramys*, *Reithroparamys*, and *Titanotheriomys*, and is very distinct from the shape in *Erethizon*, where the facet is very broad and irregular. The facet is much less oblique than in *Neoreomys* or *Paramys*, resembling *Reithroparamys* and *Erethizon* in this respect. The ental facet appears to be an oval, elongate anteroposteriorly, as in *Reithroparamys*, *Titanotheriomys*, and *Neoreomys*, and not to broaden distally as in *Paramys* and, to a lesser extent, in *Erethizon*. It is impossible to be certain of this, however, owing to the impossibility of freeing the bone from the matrix. The groove between the two facets is rather similar to that in *Reithroparamys* and *Titanotheriomys* and is much deeper than in *Marmota*. It is, however, very much shallower than in *Erethizon*, and there is no trace of an overhang of the groove by the facets as in the latter genus. It appears to be narrower than in *Neoreomys*. In general arrangement the groove is not too distinct from conditions in *Paramys*, but it lacks the numerous nutritive foramina found in the groove of the latter genus, which are also present in *Erethizon*. It seems possible that these may be associated with the larger size of the two latter genera. There do not appear to be any particular resemblances between the astragalus of *Platypittamys* and of *Eocardia* (Scott, 1905, p. 469). As indicated above, the astragalus of *Platypittamys* shows some general similarities to that of various of the later South American hystricomorphs, though no very striking similarities to any par-

ticular members of the group. There are quite notable differences from the astragali of most of the Santacrucian genera, particularly of *Steiromys*, *Eocardia*, and *Sciamys*.

One calcaneum is preserved in each of A.M.N.H. Nos. 29601 and 29602. The former is lying on its side and is somewhat broken. The latter is lying with its plantar surface exposed, and the upper surface is not available for study. The tuber is fairly long, quite slender, and of uniform width throughout. It is expanded slightly, dorsoventrally, at its posterior end. The groove for the tendon of Achilles is not very deep or bounded by sharp ridges. In these respects the bone is quite similar to that in *Reithroparamys* and *Paramys*, being perhaps somewhat more like the latter genus. It is also quite similar to that of *Sciamys* (Scott, 1905, p. 424, pl. 67, fig. 3). The process for the lateral ligament was much smaller than in *Paramys*, *Ischyromys*, or *Aplodontia*, being quite similar to the condition in *Reithroparamys* and *Parapedetes*. The exact situation in *Platypittamys* is not entirely clear, since there has been some breakage in this region in A.M.N.H. No. 29602. The lateral side of the distal end of the bone extends quite far forward, on the plantar surface at least, so that the cuboidal articulation, from this aspect, is diagonal. This places the ental facet far posteriad. The dorsal surface apparently does not show this displacement, to judge from the character of the cuboid. The calcaneum extends distally about to the middle of the navicular, forming a calcaneo-navicular contact as in *Cupidinimus* (Wood, 1935, p. 227, fig. 153), instead of the calcaneum and astragalus having their distal ends about even, as in *Paramys* and *Reithroparamys*. Scott's description of conditions in *Neoreomys* (1905, p. 398) seems quite similar to the present form, whereas *Eocardia* (*ibid.*, p. 469) would appear to be very different. There is absolutely no similarity to the calcaneum of erethizontids, *Steiromys* (*ibid.*, pl. 66, fig. 9) and *Erethizon* being equally divergent from the present form. *Sciamys* shows considerable similarity to *Platypittamys*. The closest similarity that has been noted, however, is with the Bridgerian *Reithroparamys*.

The cuboid is well preserved only in A.M.N.H. No. 29602, where it is seen from the dorsal aspect. It is narrower distally than proximally and has the proximal face inclined to the long axis of the foot. Essentially the same condition is found in *Paramys delicatus*, *Ischyromys*, *Dasyprocta*, *Cuniculus*, and *Chinchilla*. In *Reithroparamys*, as in *Aplodontia*, *Dolichotis*, *Lagosto-*

mus, *Cavia*, *Myocastor*, and *Pedetes*, the bone is rectangular, with the mesial and lateral faces subparallel. In all other forms with which it has been compared, the bone is trapezoidal or, in the Erethizontidae, essentially triangular. There is only a single proximal facet, that for the calcaneum. As far as could be told there is no naviculo-cuboid facet, although the two bones are very close together, and one may have been present. In the relationships of these bones, *Platypittamys* differs from *Paramys delicatus* and *Reithroparamys* as well as from *Sciamys*, *Eocardia*, *Hystrix*, *Coendu*, *Steiromys*, and *Chinchilla*, where there is neither an astragalo-cuboid nor a naviculo-calcaneal articulation, and from *Ischyromys*, where there is an astragalar-cuboidal articulation. It resembles such forms as *Myocastor*, *Cuniculus*, *Dasyprocta*, *Cavia*, and *Parapedetes*, where there is a marked naviculo-calcaneal articulation. *Dolichotis* and *Lagostomus* show a proportionate increase in the length of the calcaneum, the latter having a calcaneo-ectocuneiform articulation (Tullberg, 1899, pl. 35, fig. 6). The calcaneal facet slopes proximoventrad, forming an angle of but little more than 45° with the dorsal face of the bone, instead of being nearly ventrical as in *Reithroparamys*, *Paramys*, and *Erethizon*. There is a strong ventrolateral process as in *Paramys robustus*, but it is somewhat larger in the present form. It is more lateral than in *Reithroparamys*, where it is barely visible from the dorsum. The cuboid appears to be distinct from that of all forms with which it has been compared. It is perhaps most nearly like that of *Paramys delicatus*, but seems to have advanced, in a direction of its own, some distance from such a stage.

The navicular has about half the anteroposterior diameter of the cuboid and is thus appreciably larger proportionately than in *Reithroparamys*, *Paramys*, and most hystricomorphs, and more nearly resembles in this respect that of *Ischyromys* and the erethizontids. In the latter group, at least, this is due to the marked reduction of the cuboid, rather than to an enlargement of the navicular, as seems to have been the case in *Platypittamys*. There is no trace of the dorsomedian process which characterizes *Reithroparamys* and is suggested in *Paramys*. As in *Reithroparamys*, the bone does not widen towards the plantar surface. The lateral halves of the proximal and distal edges are essentially parallel, when viewed from above, while the bone tapers mesially from its center. In *Paramys*, the navicular has a nearly uniform

anteroposterior diameter, while in *Reithroparamys* its dorsal surface is constricted in the middle of the bone, so that neither of these forms resembles the conditions in *Platypittamys*.

The ectocuneiform is a large quadrate bone with its greatest diameter anteroposterior. In this it resembles that of *Reithroparamys* and of *Paramys* and is also rather similar to that of *Cuniculus*, *Dasyprocta*, *Chinchilla*, *Dolichotis*, *Sciamys*, and *Parapedetes*. It shows no particular resemblances to the bone in erithizontids, *Hystrix*, *Lagostomus*, or *Cavia*.

The mesocuneiform is also quadrate in dorsal aspect, but it is only about half the width and two-fifths the length of the ectocuneiform. Its greatest width is transverse. It is proportionately considerably smaller than in *Paramys*. This bone is not known in *Reithroparamys*. It appears closest to that of *Cuniculus* among living hystricomorphs.

The ectocuneiform is not preserved in any of the available material, but from the position of metatarsal I of A.M.N.H. No. 29601 it seems clear that it was considerably elongate, anteroposteriorly, extending quite far down the side of the second metatarsal. A similar elongation is seen in *Myocastor* and various hystricomorphs in which the hallux is vestigial. In *Paramys*, the ectocuneiform is long, but nowhere near so long as in *Platypittamys*.

There are five toes present, which are closely appressed, forming a long, narrow foot. Metatarsals III and IV are of essentially the same length and are equally massive. Metatarsal II is about the same length and thickness, but it extends farther proximad, so that its distal end does not reach to the ends of the other two metatarsals, about as in *Sciamys*. Metatarsal V is slightly more slender than the others and is slightly shorter than metatarsal II. It also extends distad in a long, olecranon-like process, well past the middle of the cuboid, where it either articulates with, or comes very close to, the lateral process of the cuboid. This is also true of *Sciamys*. The first metatarsal is buried on A.M.N.H. No. 29602 beneath the others. But on A.M.N.H. No. 29601 it may be seen to be a much shorter bone than any of the other metatarsals, being only about two-thirds their length, and much more slender, again suggesting the conditions in *Sciamys*. These characteristics of the metatarsals are very similar to the situation in *Paramys*, and are quite different from what is seen in *Reithroparamys*.

The general shape of the foot, with long, narrow, closely appressed metatarsals, all extending nearly the same distance distad and with no suggestions of proximal divergence, is suggestive of such hystricomorphs as *Dasyprocta*, *Dolichotis*, *Chinchilla*, and *Lagostomus*, although there has been no digital reduction as in these genera. The bones are much more elongate than in *Neoreomys* or *Eocardia*. The foot as a whole has no resemblance to that of *Sciamys*. There is no suggestion, either in *Paramys* or in *Reithroparamys*, of such an adaptation.

The digits are long and slender and are tipped with heavy, hoof-like claws, suggestive of those of *Sciamys*, *Myocastor*, *Cuniculus*, and *Cavia*. They are not so compressed as in *Paramys* and *Reithroparamys*. They do not appear to be so heavy as in *Steiromys* and *Coendu*.

Although it is impossible to present absolutely accurate limb ratios, they can be approximated. The hind limbs are roughly 50 per cent longer than the front, though, since no tibia is complete, it is impossible to be certain. The intermembral index, as calculated, comes to 67.6 or less. This is very similar to that in *Sciurus* and *Paramys* and is also quite close to the scampering heteromyids, *Perognathus*, *Liomys*, and *Heteromys* (Wood, 1935, table 5). The ratios computed from Scott's restorations of *Neoreomys* (Scott, 1905, pl. 70) and *Eocardia* (*ibid.*, pl. 71) are 71.6 and 67.9, respectively, which do not differ significantly from the other forms. These two Santacrucian genera, however, differ from *Platypittamys*, and from the others listed, in that the radius is considerably shorter than the humerus. This same condition holds in *Ischyromys* (Wood, 1937, pl. 25, figs. 3, 4), where, however, the intermembral index is considerably higher. In *Paramys*, also this condition of a short radius holds true. The humerus of *Reithroparamys* is not known, so its ratio cannot be determined. These ratios are considerably lower than those of *Dolichotis* (87.5) and *Paradolichotis* (81.7) based on measurements given by Kraglievich (1930); or *Hydrochoerus* (78.3) and *Prothydrochoerus* (73.1) as given by Kraglievich (1940). The front limbs seem to have been more nearly equal in length to the hind limbs than in *Sciamys* (Scott, 1905, p. 423).

On the basis of the intermembral index (table 5), which has proved to be a useful guide to the habits of rodents, *Platypittamys* is close to *Eocardia*, *Neoreomys*, *Perognathus*, *Heteromys*, *Paramys*, and *Sciurus*. The ricochetal forms (*Dipodomys*) have a greatly

reduced intermembral index, and the fossorial (*Cynomys*, *Ischyromys* ?) and cursorial (*Dolichotis*, *Paradolichotis*, *Hydrochoerus*) forms show an increased one. The intersegmental index for the hind limb is close to that of *Paramys*, *Reithroparamys*, *Neoreomys*, *Eocardia*, and *Marmota*. For the front limb, the scampering heteromyids *Perognathus*, *Heteromys*, and *Liomys*, and *Ondatra* and *Prothydrochoerus* are the closest. This does not lead to a very clear picture of the function of the limbs in *Platypittamys*.

TABLE 3

MEASUREMENTS (IN MILLIMETERS) OF LIMB BONES

	Humerus	Radius	Femur	Tibia
Platypittamys	18.2	17.5	26.5	26.8
Neoreomys (after Scott, 1905)	38.5	29.5	48.5	46.5
Eocardia (after Scott, 1905)	42	32	53	56
Dolichotis (av. of 3)	115	146	131	166
Paradolichotis	71	75	77	102
Hydrochoerus	250	269	303	360
Prothydrochoerus	171	127	209	196
Dipodomys ordii (after Wood, 1935, table 3)	15.2	17 0	28.5	38.5

TABLE 4

INTERSEGMENTAL INDICES

	Humerus/ Radius	Femur/ Tibia
Platypittamys	1.04	0.99
Neoreomys	1.30	1.04
Eocardia	1.31	0.95
Dolichotis	0.79	0.79
Paradolichotis	0.95	0.76
Hydrochoerus	0.93	0.84
Prothydrochoerus	1.35	1.07
Ischyromys	1.32	1.13
Heteromys	1.10	0.88
Liomys	0 97	0.88
Perognathus flavus	0.97	0.84
Paramys delicatus	1.29	1.04
Marmota	0.85	1.00
Ondatra	0.98	0.72
Reithroparamys	—	0.94

TABLE 5

INTERMEMBRAL INDEX

$$\left(\frac{R + H}{T + F}\right) 100$$

Platypittamys	67.6	*Dipodomys*	44.4–50.1
Neoreomys	71.6	*Heteromys*	64 0
Eocardia	67.9	*Paramys*	68.4
Dolichotis	87.5	*Sciurus*	68.5
Paradolichotis	81.7	*Ischyromys*	78.6
Hydrochoerus	78.3	*Aplodontia*	75 3
Prothydrochoerus	73.1	*Cynomys*	
Perognathus	64.5–78.0		

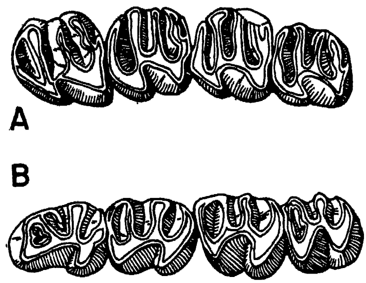

FIG. 7. *Theridomys aquatilis*. A. LP^4–M^3, Brit. Mus. No. 27756*b*. Upper Stampian, Cournon, Auvergne. B. LP_4–M_3, Brit. Mus. No. 27756*a*. Upper Stampian, Cournon, Auvergne. Both × 5.

In view of these rather diverse suggestions, it seems probable that *Platypittamys* was not well adapted for saltatorial, amphibious, climbing, or burrowing locomotion, and that, in view of the parallelism of the digits, it was probably a scampering ground dweller, passing through the initial modifications for a cursorial adaptation but still retaining a fairly strong posterior dorsal musculature, used in sitting up on its haunches, perhaps to feed.

RELATIONSHIPS OF *PLATYPITTAMYS* TO OTHER RODENTS

There are three main problems in connection with the relationships of *Platypittamys:* (1) its relationship to the other South American hystricomorphs; (2) what forms seem most likely to have been its ancestors; and (3) what its relationship is, if any, to some of the other rodents that have been suggested as having relationships with the South American hystricomorphs. To a

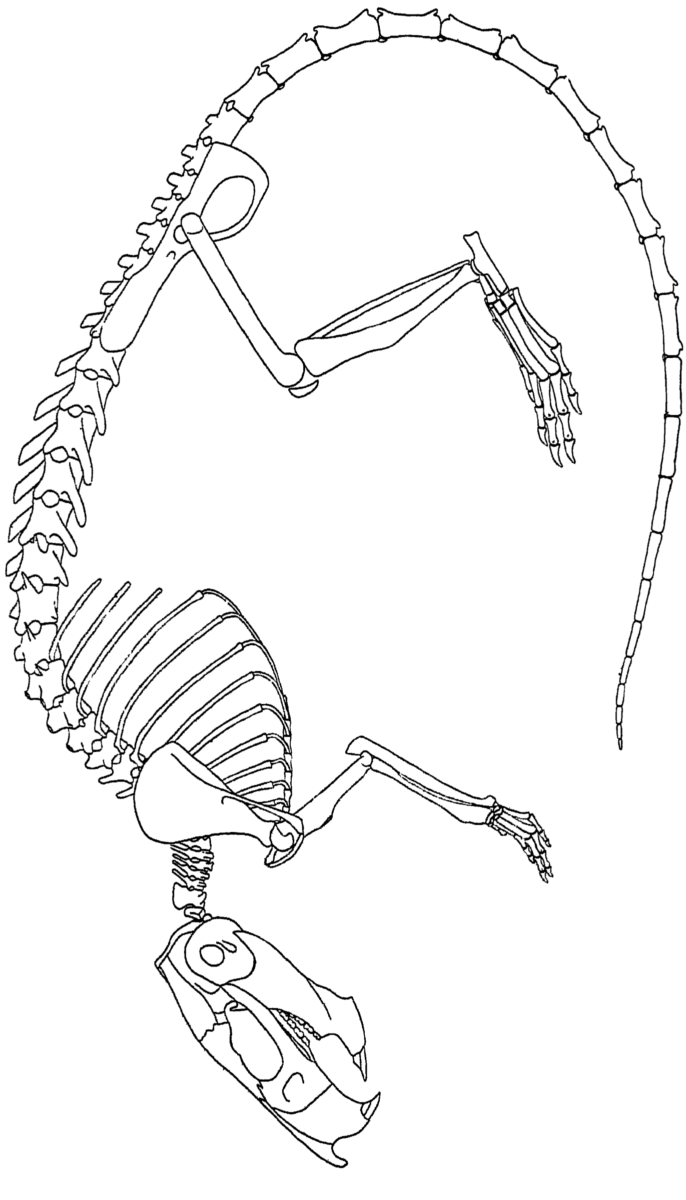

FIG. 8. Restoration of the skeleton of *Platypittamys brachyodon*, based on all three available specimens plus restoration of the missing bones. × 1.

considerable extent these points have been considered in connection with the morphological description, but it would be worth while to pull all the loose strings together and summarize the relationships here.

It seems clear that *Platypittamys* is a member of the Acaremyidae and reasonably closely related to the other members of the family. Even if it were not too late in time, it does not appear that it would be possible for it to have been the direct ancestor of *Sciamys* and *Acaremys*, because of various points, particularly in the structure of the limbs, that suggest that *Platypittamys* was developing locomotor habits different from those of the other members of the family. Its dentition shows, however, that it is close to being the structural ancestor of the other members of the family in this respect. *Platypittamys* appears to be the most primitive Deseadan rodent known, which may indicate that the Scarritt Pocket local fauna is slightly older than the typical Deseadan fauna.

As was indicated earlier, the acaremyids and the erethizontids agree in possessing a tooth pattern that seems to be close to the primitive pattern for the South American hystricomorphs, and one from which the dental patterns of all the other forms could have been derived. In all the other characteristics studied, *Platypittamys* shows no resemblance to the conditions in the erethizontids, except for the fact that they are both hystricomorphs, and it seems certain that the acaremyids could be neither ancestral to, nor descended from, the erethizontids. Although nothing is known of the Deseado erethizontids other than their teeth, by the Santacrucian this family had already acquired essentially its modern locomotor adaptations, and very possibly they had already started in this direction by the Deseado. On the other hand, there does not seem to be any very valid reason why the Acaremyidae could not have been ancestral to the Chinchilloidea, Cavioidea, and Octodontoidea (excepting the African families that Simpson included in this superfamily). In the locomotor adaptations, *Platypittamys* seems to foreshadow a considerable number of the later South American groups, and could be either an actual ancestor to some of them or merely a short, sterile offshoot of the common ancestral stock, which had begun to develop cursorial specializations.

The closest structural similarities of *Platypittamys*, among the later Hystricomorpha, appear to be with *Chinchilla*, but there are

many points of similarity to other forms, and *Platypittamys* does not show enough resemblances to the chinchillids to justify its being grouped with them. If a superfamilial allocation for the acaremyids is required, however, it would probably be best to place them in the Chinchilloidea, although it is felt that this would obscure their relationships to other groups.

The two sources that have been commonly suggested as the origin of the hystricomorphs are the paramyids and sciuravids on the one hand and the theridomyids on the other. The paramyids are known from Europe and North America, from the uppermost Paleocene to the Oligocene. The sciuravids are known only from the Eocene of North America, and the theridomyids (excluding those forms that are frequently but almost certainly incorrectly referred to this family) only from the Upper Eocene and Oligocene of Europe. The temporal and geographic relationships would make it almost impossible that the theridomyids could be ancestral to *Platypittamys*, but the pattern of the teeth clinches the argument, by making it structurally impossible as well. The complete absence of the mesoloph and mesolophid in *Platypittamys* in particular and the South American hystricomorphs in general would seem to indicate that it cannot be descended from the theridomyids, where at least the former of these structures is well developed. This point of view is strengthened by the structure of the premolars and by the other comparisons that have been made. As has been shown, there are numerous similarities to various paramyids and sciuravids, particularly to *Reithroparamys*. If skeletal material of sciuravids were available, there could well be close similarities to some members of that family. In spite of this, there are important differences from all known members of both the Paramyidae and Sciuravidae. Many of these differences seem to indicate merely that the South American hystricomorphs had already become South American hystricomorphs by the Deseadan, and hence would be no insurmountable obstacle to their derivation from the paramyids or sciuravids. However, the structure of P_4^4 does not fit with their derivation from any known sciuravid or paramyid, unless there has been a marked simplification of the tooth pattern, followed by a respecialization, which does not seem reasonable. However, Eocene sciuravids are known from a very limited geographic area (Wyoming, northern Utah, and Colorado) and Eocene paramyids only from France, Wyoming, California, Utah, Colorado,

New Mexico, and British Columbia. It seems axiomatic that there must have been a considerable number of other forms of both of these families, living in other regions, and that they must have differed structurally from the forms that we know. The ancestral South American hystricomorphs must have reached that continent, probably over a chain of islands, either along the line of Central America or of the West Indies, and must therefore have been derived from forms living not in Wyoming but in Mexico or the southeastern United States. Therefore, while it is impossible to derive *Platypittamys* from any known paramyid or sciuravid, it seems certain that its middle Eocene ancestors would have been forms which, when they are discovered, will fit either into the Paramyidae or the Sciuravidae. If the skeletons of members of the latter family were known, it seems certain that we could now tell to which family such an ancestor would have belonged.

There remains the problem of the relationships of the Acaremyidae to various other forms. The similarities to the Ischyromyidae, while certainly real, seem to be due merely to the fact that they are both early Oligocene groups, both descended from Eocene Paramyidae or Sciuravidae, and that neither has diverged to any very great extent from the ancestral conditions. *Pareumys*, in particular, shows certain similarities to *Platypittamys*, which may indicate that both the acaremyids and the ischyromyids came from the same group, perhaps of sciuravids (Burke, 1935, p. 9). *Phiomys* and its relatives show no more similarities to *Platypittamys* than do most other small, brachyodont, relatively unspecialized rodents. Until they become known from better material than at present, it may be impossible to determine their correct relationships.

Several other Old World families might be considered in this connection—the Hystricidae, Bathyergidae, Pedetidae, Thryonomyidae, and Petromyidae. As pointed out above, there are certain similarities in the foot and leg between *Platypittamys* and *Parapedetes*. In most of the rest of the skeleton, however, there are no suggestions of relationships. As far as can be told with the present lack of knowledge of the ancestry of the pedetids, there is no basis for suggesting relationships between the pedetids and the acaremyids.

The bathyergids, when first known in the lower Miocene, have already lost their premolars, so that they obviously cannot be

ancestral to the South American forms. As far as can be told from their morphology, they are very different throughout. Only one fossil form certainly referable to the Thryonomyidae is known, and the Petromyidae are unknown as fossils. Any interpretations of the relationships of these families must therefore be based on the Recent forms. These do not, however, show any very significant relationships to the acaremyids. More fossil hystricids are known, being represented in Europe as far back as the Oligocene.[1] The published figures, however, do not seem adequate to permit an accurate interpretation of the tooth anatomy. There certainly seems to be no particular relationship between the hystricids and the acaremyids.

At present it does not seem possible to prove that none of these Old World forms is related to the South American ones, although for paleogeographic reasons any such relationship seems essentially impossible, and it is equally impossible to establish any particular relationship with the South American forms that would fit with what is known of rodent paleontology. It would seem that the conclusion that there is no special relationship between the South American and the Old World hystricomorphs is inescapable, the only connection between the two groups being that of common descent from paramyids or sciuravids, which would presumably be true for all the other rodents as well. That is, it would appear that it will shortly be necessary to revise the classification of rodents thoroughly in order to bring the grouping of families closer to what seems to be the true phylogenetic relationships within the order. As suggested by Simpson (1945, p. 210), it will probably be necessary to separate the hystricomorphs into three distinct groups, but it does not appear advisable to do this until it can be combined with a review of the rest of the order. This would involve an extended series of studies, some of which are already under way.

If the classification needs revision, it would be worth while to look into the matter of the basis of the present arrangement. Fundamentally, most classifications of the order are based on the structure of the masseter muscle and its relationships to the infraorbital foramen. In general, authors have considered, either tacitly or explicitly, that each of the various zygomasseteric struc-

[1] Friant (1935) has figured unworn teeth of *Hystrix* and *Atherura*. These show a crown pattern dominated by a confusion of tubercles. There are, however, clearly five crests in both the upper and the lower molars.

tures was acquired only once during the course of rodent evolution, and therefore that each type of zygomasseteric pattern represents a natural subdivision of the order. In spite of the well-known danger in basing a classification on a single character, this was considered justifiable because such structures were thought too complex to have been likely to have arisen on several different occasions. Up to the present time, so little is known of rodent phylogeny that it has been impossible either to prove or to disprove this assumption. In fact, with the exception of one family in which the zygomasseteric region has remained in its primitive condition (the Aplodontidae), there are no modern families that can be shown to have been derived from any specific ancestral families outside the limits of their own superfamilies. This is not meant to imply that the Paramyidae and Sciuravidae do not probably represent the Eocene or Paleocene source of most of the modern rodents, but merely that, until the transitional stages are found and studied, this presumed fact cannot be held to be demonstrated. To cite an analogous case, the situation is rather similar to what we would find in regard to carnivore phylogeny if the Miacidae were unknown.

Changes will probably have to be introduced into the concept of the uniqueness of each type of zygomasseteric variant. The earliest (and hence, presumably, the most primitive) known rodents all had small masseters, limited to the ventral surface of the zygoma. They also all possessed rather large, circular, infraorbital foramina, with no relationship to the masseter. Such are found in all the typically Eocene rodents, particularly in the Paramyidae and Sciuravidae, and in such later forms as the Ischyromyidae, Mylagaulidae, and Aplodontidae—that is, in the families that have been grouped elsewhere (Wood, 1937, 1947) as the Suborder Protrogomorpha. Incidentally, the use of this group as a fourth suborder of rodents makes the same implicit assumption of the uniqueness of each variant as do the other classifications.

Platypittamys shows a marked increase in the size of the infraorbital foramen, apparently without any corresponding enlargement of the masseter. Such an enlargement of the foramen should be, genetically, a simpler change to bring about than the enlargement of the masseter. It might well have developed independently in a number of distinct lines of rodents. It also seems probable that, once the enlargement of the foramen had occurred, an

expansion of the masseter through such an opening could develop with great rapidity. On the other hand, the infraorbital foramen of the protrogomorphs is sufficiently large so that the masseter could spread through it without any previous increase in the size of the foramen. The fact that the infraorbital foramen is considerably larger in the South American hystricomorphs than in the Hystricidae may indicate a difference in the manner of development of the zygomasseteric structures in these two groups.

Initially, the rodents became separated from other mammals by the development of chisel-shaped incisors, used in gnawing. This requires a different usage of the jaw muscles from other types of chewing, and a number of modifications of the muscles, skull, and jaws took place. By the Eocene, these changes had already occurred, and the rodents became a successful and diversified group. However, the main muscle used by these forms was the temporalis, which would serve to close the jaw or to pull it backward. The masseter was much weaker and, although it would serve to pull the lower jaw forward, must have permitted only a lesser efficiency of gnawing and perhaps resulted in the limitation of the diet to relatively soft foods.

It would seem that in the Eocene the rodents had reached an evolutionary plateau, based on the gnawing of relatively soft materials, and that they underwent a wide adaptive radiation at this level. This is borne out by the fact that the Eocene rodents had not developed hypsodont cheek teeth. Since the number of ecologic niches available to the rodents would be limited, and since it seems probable that they were very much more abundant than the existing collections would indicate, there must have been severe competition among the rodents, which would have developed a strong positive selective value for those mutations that caused an increase in the efficiency of the gnawing mechanism by an increase in the size of the masseter. This would have permitted the gnawing of a wider variety of harder foods, which would lead to the subsequent development of hypsodonty in the cheek teeth of many groups. All present information points towards the rather sudden development, near the close of the Eocene, and independently in a large number of separate groups of rodents, of modifications of the skull and jaws correlated with an increase in the size of the masseter. These changes do not seem to have been limited to any one area but appear to have occurred at least throughout the northern land mass, and may have devel-

oped only after the appropriate evolution of certain types of potential food plants.

At any rate, if the masseter of a paramyid or sciuravid were to increase in size, there would be only three ways in which it could enlarge its area of origin without interfering with the eyes: (1) an increase in the size of the zygoma; (2) expansion up the front of the zygoma, onto the face; (3) expansion up the inside of the zygoma, and eventually through the infraorbital foramen onto the side of the snout.

After such expansions took place, there undoubtedly followed other modifications of the infraorbital foramen and of the zygoma. The first of these three types of modifications has occurred in the Castoridae, in *Cuniculus*, and in other forms to a lesser extent. It is not known to have developed without one of the other types of modifications as well. The second type is the "sciuromorph" condition, found also in *Titanotheriomys*, and the third is the "hystricomorph" type. The "myomorphs" combine the second and third types. But, as has been pointed out, we are unable to show that any one of these suborders represents a natural group descended from a common ancestral stock. The "sciuromorph" zygomasseteric type is found in the Sciuridae, which possess many characteristics suggestive of direct derivation from paramyids; in *Titanotheriomys*, which as an ischyromyid is also derived from the paramyids or sciuravids but which cannot be closely related to the Sciuridae; in the Castoroidea, which show very few other characters suggesting relationships to the Sciuridae; and in the Geomyoidea, which appear in most respects to have more to do with the "Myomorpha" than with the "Sciuromorpha." As has already been indicated, it seems very probable that the "hystricomorph" construction arose independently two or more times. The inclusion of the Dipodoidea and perhaps of the Gliroidea in the "Myomorpha," as Simpson pointed out (1945, p. 205), is also open to some question.

If, as seems logical, the zygomasseteric structures have originated as has been suggested, there does not appear to be any reason why similar mutations should not have been selected in a similar manner by similar environmental conditions in distantly related forms, in different parts of the world. If this is the case, a classification based on such characters would prove to be unnatural, and the whole of rodent subordinal classification would have to be restudied. This, of course, would require extensive

investigations of a large number of groups entirely beyond the scope of the present work.

If this interpretation of the evolutionary changes involving the masseter and the infraorbital foramen is correct, and it seems increasingly probable that it is, it will be necessary to revise completely our present concepts of the superfamilial or subordinal relationships of the rodents. Such a revision could solve many of the paleogeographic problems presented by our present knowledge of rodent classification and distribution. When such a revision is made, it might result in bringing the Sciuridae and the Paramyidae close together; uniting the Cricetidae, Muridae, Eomyidae, and perhaps the geomyoids; separating the Castoroidea from all other "sciuromorphs"; and presenting an arrangement of the "Hystricomorpha" that would fit the Tertiary isolation of South America from the rest of the world.

CONCLUSIONS

In summary, it seems clear that *Platypittamys* represents the most primitive South American rodent known up to the present time. While it cannot be ancestral to all the other South American forms, because it is too late in time, it suggests very strongly that the family to which it belongs, the Acaremyidae, is structurally ancestral to all the South American hystricomorphs except the Erethizontidae, which appear to have diverged early from the other forms. *Platypittamys* had already begun to develop cursorial adaptations, although it was still primarily a scampering form. The masseter muscle apparently had not yet invaded the infraorbital foramen, although the foramen had enlarged considerably over the conditions found in the primitive rodents. The cheek teeth of *Platypittamys*, while more primitive than those of any other South American hystricomorph in the lowness of their crowns and the lack of any accessory complications, show the basic pattern from which all the later forms could have been derived, although the structure of the premolars suggests that this genus is on a definite sideline.

Platypittamys apparently is a descendant of the North American Eocene Paramyidae or Sciuravidae, although it cannot be a descendant of any form known as yet. *Reithroparamys* apparently is the most closely related form. There are no indications of relationships between *Platypittamys* and any Old World forms, particularly none with the Theridomyidae.

On the basis of this and other considerations, it is suggested that the principal types of zygomasseteric structure, which have served as the basis for the separation of the specialized rodents into three suborders, the Sciuromorpha, Myomorpha, and Hystricomorpha, all derived from a more primitive group, the Protrogomorpha, may not represent single derivations but may have developed independently several times, in which case a thorough revision of rodent classification will be necessary.

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A STUDY OF THE SPECIES OF THE GENUS *STRETCHIA* (LEPIDOPTERA, PHALAENIDAE, HADENINAE)

By James H. McDunnough[1]

In the 1938 "Check list of North American Lepidoptera" five species and one subspecies were included in the genus *Stretchia*. Of these, *behrensiana* Grote was only doubtfully placed under this generic heading, owing to a certain similarity caused by the confluent nature of the orbicular and reniform spots. The species is entirely unknown to the author apart from Hampson's illustration of the type female (1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 390, pl. 89, fig. 10); if, however, Smith's identification should prove correct (1891, Trans. Amer. Ent. Soc., vol. 18, p. 120) then his figure of the male genitalic clasper (*ibid.*, pl. 2, fig. 9) would indicate that the placement in *Stretchia* is erroneous. In the present paper therefore *behrensiana* is omitted from consideration.

Considerable difficulty has been experienced in the past in securing adequate determinations of the remaining and strictly congeneric species, viz., *plusiiformis* H. Edwards, the genotype, with its so-called variety *coloradicola* Strand, *prima* Smith, *inferior* Smith, and *muricina* Grote. Since the unique specimens on which four of these names were based are all contained in the collection of the American Museum of Natural History, the occasion seemed opportune to initiate a study of these types and their genitalia with a view to clarifying the situation and securing definite identifications. As, apart from the types, the American

[1] This study was accomplished under the sponsorship and through the generosity of Mr. Cyril F. dos Passos, Research Associate in the Department of Insects and Spiders of the American Museum of Natural History.

Museum material was very inadequate for such a project, recourse was had to other institutions and collectors, and through the generous response of the curators of the United States National Museum, the Canadian National Collection, and the Los Angeles County Museum, as well as of Messrs. J. Sperry, W. Bauer, O. Buchholz, and others, a considerable number of specimens was brought together. Unfortunately what, at the outset, appeared to be a fairly simple procedure proved to be beset with many difficulties when it came to matching specimens with the types. In the first place all four types are in poor condition, being old, worn, and undoubtedly faded; in consequence accurate comparisons in respect to the coloration and maculation of the primaries were almost impossible without leaving a certain existing element of doubt. To further complicate the matter, it was found, when it came to making slides of the genitalia of these types, that in three instances, where the names were based on male specimens (*prima* was based on a female), J. B. Smith, following his usual custom, had broken off the right claspers in order to present figures of these portions of the organs in his *Perigrapha* revision (1889, Proc. U. S. Natl. Mus., vol. 12, pl. 22, figs. 2–4). As a consequence of this procedure the remainder of the genital organs had been either partially damaged or almost completely ruined and even when carefully mounted in Canada balsam, as has now been done, could not be compared with other undamaged mounts with any degree of certainty that the comparisons were correct. The similarity of maculation in all of the species together with a marked variation in the depth of the ground coloration of the primaries in series from certain localities was a further stumbling block. In only one instance, *inferior* Smith, did the male genitalia prove to be entirely satisfactory as a means of specific separation, and the differences between such female organs as could be examined were so slight as almost to prohibit their usage in this connection at the present time until more material could be procured for study.

The best means of separating the four described species has been found to exist in the structure of the female antennae, and using such a character it has been possible to fix fairly accurately the typical forms represented by the names involved. A certain element of doubt still exists as to whether each name represents a distinct specific entity or whether we are not dealing with a single species which is subject to considerable structural and color variation according to the localities in which the forms occur. This

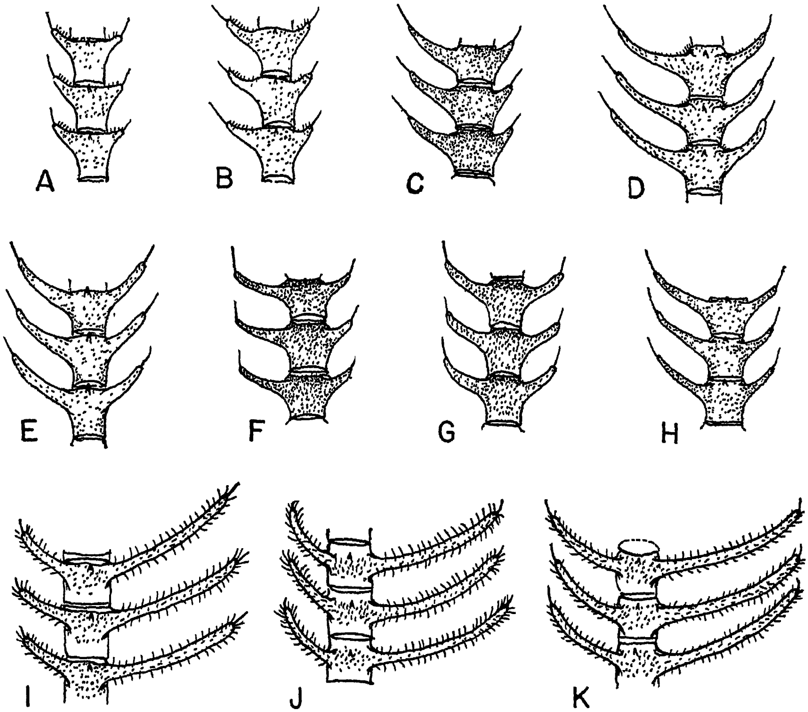

FIG. 1. Female antennal segments: A. *Stretchia prima*, holotype. B. *S. plusiiformis* (Dividend, Utah). C. *S. pictipennis*, allotype. D. *S. inferior* (Los Angeles, California). E. *S. muricina* (Vancouver Island). F. Variety of *S. muricina* (Medicine Hat, Alberta). G. Variety of *S. muricina* (Moscow, Idaho). H. *S. pacifica*, allotype. Male antennal segments: I. *S. plusiiformis*, holotype. J. *S. inferior*, holotype. K. *S. muricina*, holotype.

problem can be solved satisfactorily only by much more intensive breeding than has so far been done; for the present each name is considered as applied to a specific entity. The species separate into two groups: In one, comprising *plusiiformis* and *prima*, the female antennal segments appear trigonate when viewed ventrally and show only slight lateral projections; they may be classified as strongly serrate or denticulate. In the second group, including *muricina* and *inferior*, the antennae are definitely bipectinate, the pectinations considerably shorter than in the male sex but still falling obviously into this category. The illustrations emphasize these points, and further details may be found in the discussion of the individual species.

The distributional areas of the various species are still only incompletely defined. In a rough way it may be said that we have a Great Basin species, *plusiiformis*, fairly typical in Nevada (type locality) and Utah. In Colorado a somewhat darker color-form occurs to which the name *coloradicola* Strand is being applied in a rather doubtful racial sense; this extends up the Rockies into Idaho, eastern Washington, and adjacent sections of British Columbia. In the foothills of western Alberta specimens occur showing a range of color variation which covers both forms, and the species extends eastward in modified forms through southern Saskatchewan into sections of northern Ontario. Through the higher altitudes of the Sierras *prima* is found to occur, and what is apparently a slight variant of this species has been collected in the adjacent Charleston Mountains of southern Nevada. *Inferior* is known so far only from southern California (Kern and Los Angeles counties); in structural characters it is the most distinctive of the group, although superficially it bears a marked resemblance to *prima*. The larva recorded by Comstock and Dammers (1939, Bull. Southern California Acad. Sci., vol. 38, pp. 183–184) from Holy Jim Canyon, Orange County, California, under the name *plusiaeformis* might easily be properly referred to *inferior*, but no adults of this brood have been available for examination. The fourth species, *muricina*, is a Pacific coast form, occurring typically from northern Oregon (The Dalles, type locality) to southern Vancouver Island, British Columbia, most of the material available having been collected in this latter locality. It would appear to range into the south central section of the province, but the eastward distribution through Canada and the northern United States has proved one of the most puzzling problems of the whole study. Paucity of material, especially of females, is partly responsible for this, but then, too, an apparent deepening of the color of the primaries, especially in the typically pale terminal areas, simulates so closely the appearance of the darker forms of *plusiiformis* as to render a placement on color characters alone almost impossible. Such females as could be examined showed antennal structural differences, not only among themselves but also as compared with *muricina* and *plusiiformis*, and these differences are illustrated and discussed later at greater length. Obviously two courses are open for a reviser to follow: either to consider such variations as merely local changes, in which case the forms could at best be given only racial classifica-

tion, or to regard them as of specific value which would necessitate creation of several new names. Until adequate material is at hand for study it seems wisest to the author to leave matters standing *in statu quo* rather than complicate things by the addition of inadequately based names.

Two new specific names are proposed, based on more adequate Californian material. One of the new species falls close to *muricina*, of which it might be considered a race, and the other one belongs in the *plusiiformis* group. A more detailed treatment of the individual species follows.

Stretchia plusiiformis plusiiformis Henry Edwards

Stretchia plusiiformis Henry Edwards, 1874, Proc. California Acad. Sci., ser. 1, vol. 5, p. 267; 1874, Pacific Coast Lepidoptera, no. 4, p. 4. Smith, 1893, Bull. U. S. Natl. Mus., no. 44, p. 208.

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Stretchia plusiaeformis, Hampson, 1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 364, fig. 97. Draudt, *in* Seitz, 1924, Macrolepidoptera of the world, vol. 7, p. 154, pl. 23b (poor figure). Barnes and Benjamin, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 180.

This species was described from a single male specimen stated to have been captured by W. S. Edwards at White Pine, Nevada, in August. The date of capture is open to question, as all members of the genus are known to fly in the early spring months. The locality is in Storey County, in the vicinity of Virginia City, and consequently on the western edge of the Great Basin area. The holotype (and genotype as well) bears, besides the name label, a written label "2920, Nevada." The specimen is in very worn condition, possibly owing to the late date of capture, and fringes are entirely lacking. Only the right antenna remains, and the genitalia show a certain amount of damage, done by J. B. Smith when the right clasper was removed for purposes of illustration.

No topotypical specimens have been available for examination, but Hampson's text figure of a Nevada male would appear to be fairly accurate. A series of males and females received from the United States National Museum and the Los Angeles County Museum, and collected at Stockton and Dividend, Utah, in late April and early May by T. Spalding, seems, as far as could be ascertained by a careful comparison, to match the type very

closely, and it is proposed to consider these specimens as typical of the species. Four males and one female from Pullman, Washington, kindly sent for study by Professor M. T. James of the State College of Washington, also run fairly close to Utah specimens although somewhat brighter in coloration; in one of these males the stigmata are separated. In a fifth male from the same locality the primaries are much deeper in coloration and the stigmata are barely contiguous; this specimen apparently is transitional to *coloradicola*.

In such specimens as those above mentioned the vestiture of the head and thorax is, in general, a deep smoky gray; the basal portion of the collar is tinged with light brown, at times obscured by the rough squamation, and there is the usual apical black band preceded by a fine dark hair line. The patagia are paler than the balance of the thorax, showing considerable whitish suffusion and a black posterior banding. The thoracic and abdominal tufts of segment I are mixed black and white. The abdomen is light brownish. In the male the ground color of the primaries is a rather even deep smoky gray, tending to become somewhat paler in the subterminal area. The confluent orbicular and reniform form together a broadly open U, more so, in general, than in *muricina*. Their color is somewhat paler than the ground color but not prominently so as in *muricina*, the filling being a dull grayish white. The interior margin of the spots shows the customary white border line edged outwardly with black, and there is a trace of brownish shading in the reniform which frequently shows a small dark spot in its lower outer corner. Occasional specimens occur in which the stigmata are contiguous but not confluent; this character has apparently little specific value, contrary to the opinion held by J. B. Smith. Dull brownish but rather obscure shading occurs in the central area of the wing below the spots and gradually merges into the ground color; in some male specimens this darker shading is entirely lacking, the coloration in consequence being an even deep gray. The balance of the maculation is improminent with the exception of a black basal dash ending before reaching the t.a. line, a dark oblique costal streak before apex of wing and a more upright one before the tornus; these, in well marked specimens, may be more or less connected by a fine brown s.t. line. The costal half of the wing at the base shows white shading and is crossed by a single, irregular, basal half line; the t.a. line can be frequently traced in the

costal half of wing and bulges outwardly crossing the cell; the fine, single t.p. line is less evident, running parallel to outer margin and forming outward teeth on the veins which are tinged with blackish in the subterminal area, broken by minute pale spots; there is a fine, black, crenulate, terminal line and the fringes are more or less concolorous with a median pale line and the outer half checkered with blackish intravenular spotting. The secondaries are evenly deep smoky with dull ochreous fringes. Beneath light smoky, the primaries more or less even in color with slightly paler terminal area, the costa narrowly brownish with three small white ante-apical spots. The secondaries paler, heavily sprinkled with smoky dots, with a prominent dark discal spot and a more or less evident postmedian line, parallel to outer margin.

In the females the maculation is much more intense, as seems usual in this sex. The brownish shading on the primaries around and below the confluent spots is deeper, and in consequence the spots themselves stand out more sharply; the subterminal area is definitely paler. The secondaries and the under side show no differences.

ANTENNAE: The greater portion of the right antenna of the holotype was intact with only the apical segments missing. A slide has been made of this, and the drawing illustrates the under side of three segments, nos. 21–23, from the middle section.

In the male antenna the basal six to eight segments are simple; short pectinations begin to appear on the following segments, and these quickly increase in length, the full size being attained at approximately segment 15; towards the apex there is a gradual tapering off in the length until in the apical fifth the pectinations disappear, the segments being narrow and bead-like with a short terminal bristle. For the greater part of their length, therefore, the antennae may be classified as strongly bipectinate, the inner branch long and slender, the outer one scarcely half the length of the inner one. Both are moderately setose and terminate in a short bristle; the insertion on the main stalk is at the distal margin, and a small spine occurs in the median area between the two bases.

As compared with the male antennae of the allied species, the differences are very slight and are hard to evaluate in dried specimens. From a study of slide material it would seem as if the outer pectination in *plusiiformis* is somewhat shorter than the corre-

sponding one in the other species, but this character may not have a great deal of value and can be used only with caution.

The female antennae offer a much better specific character than do those of the males. Unfortunately material in this sex has been very limited, and the antennae, in such specimens as were available, were frequently broken off, making it impossible to check the range of variation as fully as should have been done.

From a female of the Dividend, Utah, series a slide of the left antennae has been prepared and an illustration of the under side of segments 25 to 27 given. The basal and terminal segments are simple, as in the male, but to a somewhat greater extent. In the median area the structure might be more accurately defined as strongly dentate or serrate rather than bipectinate. Each segment has, when viewed ventrally, a broad trigonate appearance; on the outer side there is a slight apical projection with a longer one on the corresponding inner side which might almost be termed a short pectination; towards the distal end of the antenna these projections tend to become subequal, owing to a shortening of the inner branch; a distinct terminal bristle is present on each side, and the whole segment is thickly covered with extremely short, fine setae. In structure the antennae differ markedly from those of *muricina* and *inferior* which are distinctly bipectinate. They are, however, very close to those of *prima*, as typified by the female holotype, in which each antennal segment is even more definitely trigonate with scarcely any distad projection on the outer side.

Male Genitalia: As noted in the introduction the right clasper had been broken off by J. B. Smith. The balance of the organ was found to be fairly intact, and it has been possible therefore to give an illustration of the left clasper with the exception of the proximal portion which had been damaged; a complete drawing of the organ, based on a Utah specimen, is also presented. The uncus is broadly spatulate, short, with a truncate distal margin; it is strongly setose; individual specimens show variation in width and length. The tegumen is moderately broad, conical, with a small peniculus. The cephalic end is extended into a long, bluntly pointed saccus or vinculum. The claspers show a slight asymmetry; a fairly well chitinized sacculus bulges in a rounded, feebly spiculate projection over the costal edge of each clasper at base (the "obtuse lappet" of Smith). The cucullus has a rather broad neck and is variable in shape, being at times rounded

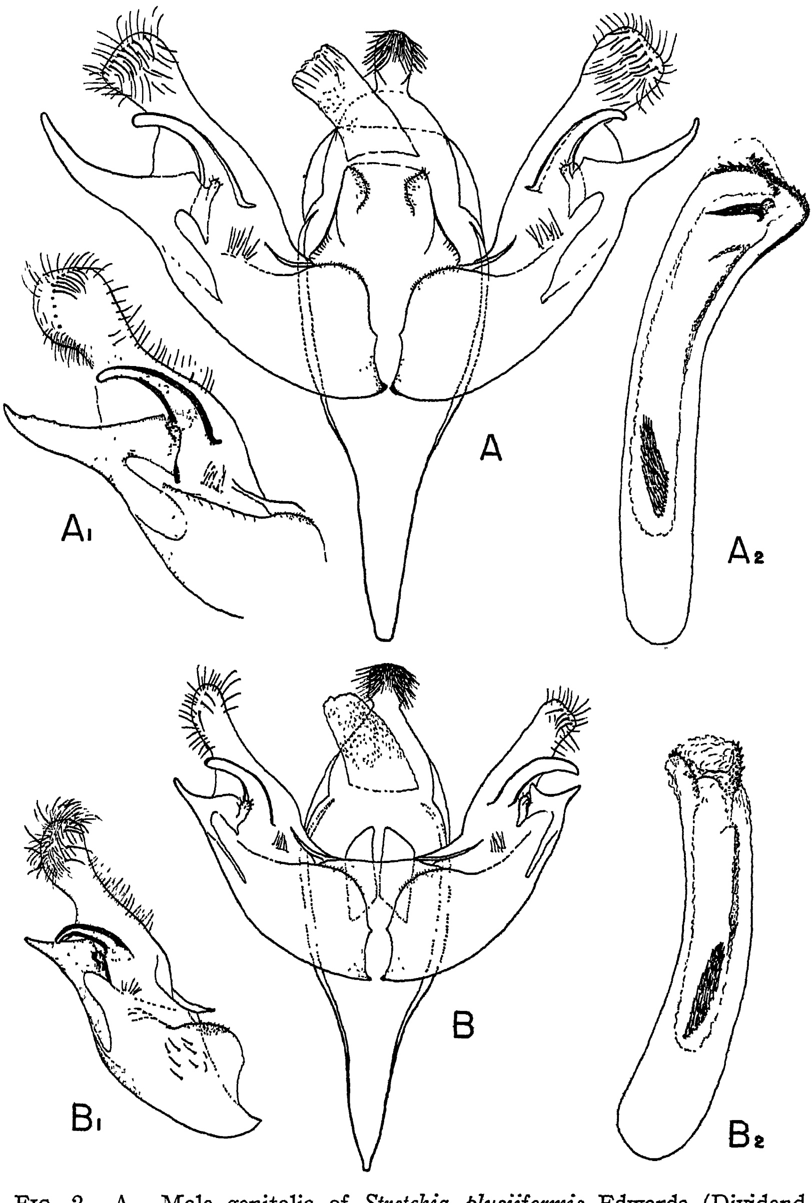

FIG. 2. A. Male genitalia of *Stretchia plusiiformis* Edwards (Dividend, Utah). A1. Left clasper of holotype of same species. A2. Aedeagus of Utah specimen. B. Male genitalia of *Stretchia inferior* (Smith) (Los Angeles, California). B1. Left clasper of holotype of same species. B2. Aedeagus of same.

apically, in other cases more truncate in appearance; it shows a weak corona, also variable, besides a sparse covering of long hairs. The interior armature of the clasper is somewhat similar to the structure found in the genus *Euxoa*. It consists of two projections; the inferior one, which is really an apical extension of the sacculus, projects obliquely over the ventral margin as a long, upcurved hook; the dorsal one, the harpe proper, arises from the central area and is strongly chitinized and bent downward apically, attaining to, or projecting slightly over, the ventral margin of the clasper; at its base is a small, raised tubercle which shows a few apical setae. The juxta is weakly chitinized and broadly rectangular. The anellus lobes are well chitinized laterally and finely spiculate. The aedeagus is somewhat curved dorsoventrally and moderately broad; apically there is present on one lobe a curved chitinous band, armed with short teeth, opposite which, on the other lobe, is a smaller dentate patch. A strong short spine with broader base is generally present in the apical region of the vesica but at times (for instance in the type slide) is missing, having been doubtless injected into the female bursa during copulation; in the proximal portion is a closely appressed, spindle-shaped bundle of cornuti.

FEMALE GENITALIA: In a slide of a Dividend, Utah, female no differences could be detected that might be used to separate the species from *prima* (*vide* illustration).

REMARKS: Typical *plusiiformis* is here considered as being a species of the Great Basin area, occurring in Nevada, Utah, and eastern Washington. West of the continental divide in Colorado the species assumes a somewhat darker coloration as exemplified by long series in the United States National Museum and other collections from Glenwood Springs, mostly collected by Barnes. Such specimens seem to be transitional to a still darker form found east of the divide in the foothill country and to which the name *coloradicola* Strand is being applied rather doubtfully in a racial sense.

TYPE: Holotype, male, White Pine, Storey County, Nevada, in the collection of the American Museum of Natural History.

Stretchia plusiiformis coloradicola Strand

Stretchia plusiiformis, DYAR, 1902, Proc. U. S. Natl. Mus., vol. 25, p. 377. HOERNER, 1937, Jour. Econ. Ent., vol. 30(6), p. 900 (biology).

Stretchia plusiaeformis subsp. 1 HAMPSON, 1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 365.
Stretchia plusiaeformis var. *coloradicola* STRAND, 1916, Arch. Naturgesch., div. A, vol. 82, no. 2, p. 30.

The name *coloradicola* was proposed for Hampson's subspecies no. 1 of *plusiiformis*, based on a single male labeled "Colorado (Bruce)." The diagnosis by Hampson is as follows: "Much darker; fore wing rather broader; stigmata not conjoined, the orbicular oblique elliptical, the reniform oblique oblong, the area around them slightly darker; postmedial line closely approximated to reniform and straight from below costa to vein 4."

It is impossible to fix the type locality exactly, as Bruce was known to have collected in various sections of the state. Until the type in the British Museum can be carefully studied, it is also rather futile to try to match the type specimen with other material, using Hampson's brief and rather vague description as a basis. However, among the material collected and bred by Dyar in the vicinity of Denver, consisting of 11 males and four females, all of which are before the writer, three male specimens are present in which the orbicular and reniform are not confluent although quite normally conjoined in the balance of the material. As the deeper coloration also appears to fit in quite well with the original diagnosis, these three specimens are considered, for the purposes of the present article, as being topotypical. Hoerner (*ibid.*, fig. 2) figures two specimens of the same race, bred from larvae found destructive to gooseberries at Manzanola, Colorado, and a long series of rather undersized specimens from this source has been placed in the United States National Museum. Considerable variation in depth of coloration is evident in this material. Two males and a female in the United States National Museum from "Clear Creek, Jeff. Co. Colo. 6–7000 ft." show a deeper and brighter coloration than any of the aforementioned specimens. The stigmata are whiter and, in the males, merely contiguous. It is possible that these are more representative of the name *coloradicola* than the Denver specimens already mentioned.

The name *coloradicola* as here employed in a rather broader sense designates the very variable form occurring in the Rocky Mountain area and extending northward through Idaho into southern British Columbia and the western section of the province of Alberta. Numerous specimens collected at Wallace, Idaho, in April and May by O. Huellemann show considerable variation,

in both coloration and intensity of maculation. While a fair proportion of the material bears a close resemblance to that from Colorado, other specimens, notably females, are brighter in coloration with greater contrast between the brown median areas and the paler, deep bluish gray, terminal portions of the primaries. In such specimens the maculation is more clearly defined, the black basal dash is generally quite prominent, and the stigmata are normally joined. Some male specimens in the United States National Museum from Pullman, Washington, show a trend in this direction, although most of the specimens studied seem better placed in the topotypical race. A single male from Rossland, British Columbia, matches the Idaho material quite well. Dyar records the species from Kaslo, British Columbia (1904, Proc. U. S. Natl. Mus., vol. 27, p. 869), based on a single specimen in the Cockle collection, the date "September 27" being obviously a mistaken interpretation of the label "27.IV." as "27.IX." Material in the Canadian National Collection from Alberta (Calgary, Lethbridge) is less typical and tends in its paler coloration to approach closer to *plusiiformis*. On the other hand, two males in the same collection from Swift Current, Saskatchewan, are very similar to Colorado specimens. Much farther east a small series of six males was collected in early May by G. S. Walley at Smoky Falls, north of Kapuskasing in northern Ontario, this material being also deposited in the Canadian National Collection. With the exception of a single very light-colored specimen all specimens show a very deep purple brown ground color, the whole median area being suffused with a brighter brown color, especially below the stigmata, and the maculation being well defined. The male antennae appear to show slightly shorter pectinations than the Rocky Mountain form, but otherwise no structural differences could be detected. This Ontario series is matched by three specimens (two males, one female) in the United States National Museum, *ex* Barnes collection, from Hymers in the Thunder Bay District of northern Ontario; the female is dated "June 16–23" but the males, probably mistakenly, bear the label "Sept. 16–23."

STRUCTURAL DETAILS: No differences of any consequence could be noted in either antennal structure or genitalia from those of the nimotypical form. A tendency was shown in some females for the lateral serrations of the antennae to be slightly longer, but this did not appear to be constant in the small series of this sex avail-

able for examination. The male genitalia match on the whole very well those of a Utah specimen given in the figure, but it should be noted that in some of the bred Manzanola series the length of the inferior projection of the harpe appeared to be shortened and somewhat aborted.

TYPE: Holotype, male, Colorado (?Denver region), in British Museum (Natural History).

Stretchia prima (Smith)

Perigrapha prima SMITH, 1891, Trans. Amer. Ent. Soc., vol. 18, p. 119; 1893, Bull. U. S. Natl. Mus., no. 44, p. 209. HOLLAND, 1903, Moth book, p. 205, text fig. 116 (type). HAMPSON, 1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 404. DRAUDT, *in* Seitz, 1924, Macrolepidoptera of the world, vol. 7, p. 157.

Stretchia prima, BARNES AND BENJAMIN, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 180.

The name *prima* was based on a single female in the Henry Edwards' collection. This specimen, considerably worn and lacking fringes, bears the label "Sier. Nev. Cal.," and no further information as to the exact locality is available from the Edwards' catalogue. In general, specimens bearing such a label are supposed to have been collected in the Donner Pass region between Summit and Truckee, but there is no possibility of verifying this in the present instance. Holland's figure of the type is fairly accurate, apart from being too dark. The primaries, basad of the subterminal area, show a coloration of a deep smoky purplish gray deeper than in *inferior* and without any trace of brownish shading over the central area of the wing. Under a lens they appear rather heavily sprinkled with white, and the cross lines are more evident than in allied species. The orbicular and reniform are outlined in white and show a whitish gray filling; they are not confluent, as in other species, but are barely contiguous at their bases. It is very doubtful, however, whether this character has the value assigned to it by Smith as a means of specific separation. Specimens, especially females, of *muricina* and *coloradicola* have been met with that show the same feature. It would appear to be merely a rather rare, individual variation, possibly more prevalent in *prima* than in the other species. The subterminal area of the primaries is contrastingly pale, forming a grayish white band across the wing. The terminal area is darker again but less dark than the basal two-thirds. The secondaries

and under side are much as in the other species. The larger portion of the left antenna was present in the type, and from a slide made of this it is evident that *prima* must be closely allied to *plusiiformis*, the trigonate segments being even less dentate than in this species with practically no projection on the outer side, as may be noted from the illustration given.

While it has been impossible to match the type exactly with any of the material available, a female specimen has been found in the American Museum collection bearing the same vague locality and collection labels. This specimen, also much worn, differs in that the orbicular and reniform are confluent and less conspicuous, and the subterminal area is less markedly pale. On the other hand, the general wing coloration matches well, the antennal structure is similar, and the genitalia (to be dealt with later) show no obvious differences. This would appear to strengthen the opinion that the type of *prima* is a rather aberrant specimen, but the puzzle can be definitely solved only when more material is available and when the type can be more closely matched than is now possible. A worn male with the same indefinite locality label, originally from the Smith collection, is in the United States National Museum, and a genitalic slide (not examined) has been made by F. H. Benjamin.

If it is assumed for the present that the second Sierra Nevada specimen is correctly identified as *prima*, two well-matching males in the Los Angeles Museum material, collected at Huntington Lake, Fresno County, altitude 6900 feet, on June 26, could be referred to this name. These specimens, while lacking the pale subterminal areas, possess contiguous rather than confluent spots and fairly well-marked cross lines. A single male from the Mt. Shasta region and a series of specimens from the Charleston Mountains, Nevada, collected in May, 1934, by Messrs. Comstock and Sperry would also appear to belong here. They show the same deep smoky gray color of the primaries, varying considerably in depth and intensity. In only one instance is there an indication of a pale subterminal band. On the other hand, the rather improminent spots in several specimens are merely contiguous, whereas in others they are confluent. Unfortunately in the single female in the series the antennae are entirely lacking so that this important character cannot be checked, but the genitalia match those of the type very closely. Benjamin appears to have reached the same conclusion regarding the identity of the Charles-

ton Mountains series, as one of the specimens examined bears his label "*Stretchia muricina prima* Sm." The reference of *prima* as a race of *muricina* is, of course, untenable. Besides a single Charleston Mountains male, the United States National Museum collection contains a male from Truckee, Nevada County, California, which matches the Huntington Lake material, and a female, simply labeled "Cal.," from the Graef collection, which shows the same antennal structure as the type. This specimen is, however, lighter in general coloration although possessing the separated stigmata and the pale terminal area.

ANTENNAE: There is nothing tangible in the structure of the male antennae whereby the species may be separated from *plusiiformis*. In the female, of which segments 25 to 27 of the holotype are illustrated, the only noticeable difference is that the short distal projection (tooth) on the outer side is still further reduced as compared with the corresponding part in *plusiiformis*. Whether such a character is constant or not can be determined only when further material is available for study.

MALE GENITALIA: Similar to those of *plusiiformis*. In four genitalic preparations examined (Huntington Lake, one; Charleston Mountains, three) no essential differences could be observed. Slight variation in the length of the inferior branch of the harpe is present in the individual specimens, and two of these show the apical spine of the vesica whereas in two others from the Charleston Mountains series it is absent.

FEMALE GENITALIA: A figure of the female organ from the holotype is given. Preparations from the second Sierra Nevada specimen, mentioned above, and from the single Charleston Mountains female agree completely. The ostium is broad and membranous, very finely spiculate. The ductus bursae is a broad, feebly spiculate, chitinous tube, slightly less than half the length of the bursa proper and strengthened laterally by chitinous rods; it narrows slightly in its distal half and enters the bursa at its proximal end on the dorsal side. The bursa copulatrix is a long membranous sac, the distal half of which is broadened into globular form and is provided with four long, narrow, equidistant, finely spiculate bands. At the proximal end, immediately ventrad of the entrance of the ductus bursae, a large secondary sac arises, extending down the right side of the bursa for half its length; at the junction of the two sacs there is a lightly chitinized, rather crenulate area. The ductus seminalis arises as a fine

membranous tube from the proximal section of this secondary sac, immediately ventrad of the termination of the ductus bursae.

REMARKS: *Prima* is being treated for the present as a species distinct from *plusiiformis*, but it could readily prove to be merely a race of this species, occurring in the higher Sierras and adjacent mountainous areas. There is very little difference in the structural details of the two, but in *prima* the deep gray coloration of the primaries with little trace of brown median shading renders it fairly easily separable from *plusiiformis*. In this respect it shows greater similarity to *inferior* which possesses, however, good differentiating structural characters.

TYPE: Holotype, female, Sierra Nevadas, California, in the collection of the American Museum of Natural History.

Stretchia pictipennis, new species

Belongs in the *plusiiformis* group but shows sufficient differences of antennal structure and general coloration to warrant consideration as a good species.

Male antennae strongly bipectinate, the inner branch somewhat longer than that of *plusiiformis;* the female antennae shortly pectinate, the outer branch scarcely longer than in *plusiiformis* and hardly more than a serration, the inner branch much longer and forming a definite pectination (as illustrated); the whole segment is shorter and chunkier than that of *plusiiformis*. Squamation of head and palpi very rough with well-developed tuft on vertex. Palpi light brownish with slight admixture of black scaling. Head largely light gray, tuft of vertex brown. Collar light brown at base, upper half deeper brown, intermingled with white scaling and with a broad, dark, apical band. Patagia and thorax in general gray, the color formed by an admixture of black and white scaling; a slight trace of apical dark bands on patagia. Thoracic tufts tipped with dark brown, apex white. (In one paratype the brown coloration of head and collar is less obvious.) Primaries with the ground color a deep purple gray, this color predominating in the basal area before the t.a. line and in the terminal portion of the wing beyond the t.p. line. Median section between the t.a. and t.p. lines shaded with brown, especially deep around the stigmata, leaving traces of the ground color along costa and above the inner margin. Maculation as in the other species of the genus but more definite in character. Basal half line distinct, black brown, with slight out-

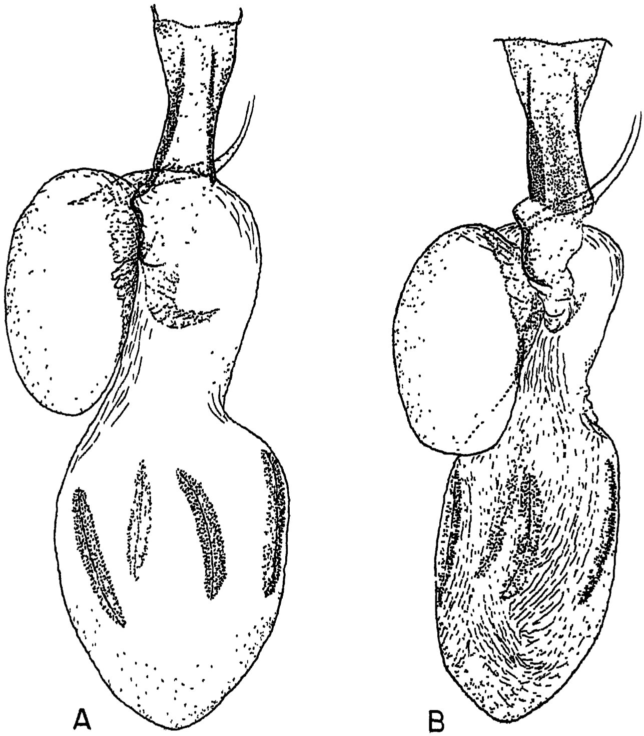

FIG. 3. A. Female genitalia of holotype of *Stretchia prima* (Smith) (Sierra Nevada, California). B. Female genitalia of *Stretchia muricina* (Grote) (Vancouver Island).

ward angle below costa, terminating at cubitus, along which are very faint indications of a dark basal dash (at times obsolete). Dark brown t.a. line distinct, especially in costal half of wing; it is outwardly oblique and consists of four scallops, small inward angles being formed on radius, cubitus, and vein 1. Orbicular and reniform confluent, forming the usual broad U mark; the filling of the orbicular and the inner half of the reniform pale gray, considerably lighter than the ground color; the outer half of the reniform more or less filled with rather ruddy brown. The lower and outer margins of the confluent spots are sharply outlined in white, this in turn being edged outwardly with black. The t.p. line is fairly well defined; starting from a point on costa above inner margin of reniform it angles sharply, continuing along radius to a point beyond the cell where it bends downward and runs al-

most rigidly inwardly oblique to inner margin; it is strongly dentate in its lower half, the dentations being more or less continued along the veins in the subterminal area by fine black streaks, broken by a row of small white dots. The s.t. line is, as usual, indicated at costa by a prominent, oblique, dark dash and at tornus by a less obvious, curved, black line; its course through the central area of the wing can be traced by the slight difference in the shades of color of the subterminal and terminal areas, the former being the paler; the line, as thus indicated, shows faint outward dentations. A broken, black, lunate, terminal line. Fringes dark with slight tinge of brown, cut basally and medially by fine, paler lines; they present a very slightly checkered appearance. Secondaries uniform deep smoky brown. Fringes concolorous with (at times) a slight ruddy tinge and a fine pale line at base. Beneath, primaries smoky with indications below costa of a postmedian line; costa with four small, white preapical dots. Secondaries paler with a slight ruddy tinge; a prominent discal spot and postmedian curved line. Expanse, 31 mm.

TYPE MATERIAL: Holotype, male, Mohawk, Plumas County, California, May 4, 1937 (W. Bauer), in the American Museum of Natural History. Allotype, female, same locality and collector, May, 1939, in same collection. Paratypes, one male, same locality and collector, May 7, 1937, in the Canadian National Collection, one male, same locality, May, 1940 (W. Winter), in collection Bauer; one female, same locality and collector, April, 1939, in collection Bauer.

REMARKS: The male genitalia show great similarity to those of *plusiiformis.* The lower branch of the harpe is generally slightly shorter but this, as well as the shape of the cucullus, is somewhat variable in the three slides examined. In the dentate patches at the apex of the aedeagus the teeth are seemingly stronger than those of allied species. No preparation of the female genitalia has been made.

The species has evidently been distributed in exchange by W. Bauer under the name of *plusiiformis*, an error for which I may be responsible: other specimens may therefore be found in certain private collections unknown to me.

Stretchia inferior (Smith)

Perigraphia inferior SMITH, 1887, Proc. U. S. Natl. Mus., vol. 10, p. 447; 1889, *ibid.*, vol. 12, pp. 491–492, pl. 22, fig. 2 (genitalia).

Stretchia inferior, SMITH, 1893, Bull. U. S. Natl. Mus., no. 44, p. 207. HAMPSON, 1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 365. DRAUDT, *in* Seitz, 1924, Macrolepidoptera of the world, vol. 7, p. 154. BARNES AND BENJAMIN, 1929, Bull. Brooklyn Ent. Soc., vol. 24, p. 180.

The species was described from a single male specimen with habitat given merely as "California." Smith distinctly states that "the unique ♂ type is with Mr. H. Edwards," so that a so-called type male specimen in the United States National Museum, although bearing the same labels as the type, must be treated as merely topotypical. The specimen in the American Museum collection is hereby designated as the holotype, and some further data regarding locality are available from labels on this specimen. Besides Smith's species label there is a printed label "California" with "Havilah" written in above it. Further, there is a round disc bearing the number "7380" which refers to H. Edwards' original catalogue, the entry under this number confirming the above locality data and recording the collector as Stretch. Finally, there is a label, "No. 10916, Collection Henry Edwards," referring to an American Museum catalogue compiled after the Edwards' collection had been purchased by this institution. It seems fairly evident from this additional information that the vicinity of Havilah, Kern County, southern California, may be safely regarded as the type locality of the species. Following the short original description, Smith mentions, in discussing the genitalia, that the "clasper is bifurcate: the inferior branch very short and acutely terminated." This is borne out by the figure, given in his revision of 1889, of the right clasper and its appendages, drawn evidently from a portion broken off from the original type.

Among the material received for study from the Los Angeles County Museum three specimens were found (two males and one female) labeled as follows: one male, "Beverly Terrace, L. A. Co. Cal. Dec. 12–Jan. 5, '29"; the other male and the female simply "Los Angeles, Cal." with the dates, respectively, "Dec. 1–25, '28" and "Mar. 1–15, '28." Another Los Angeles male, "Feb. 5, 1921, Karl R. Coolidge," is in the United States National Museum, and a fourth male from the same locality, "Mint Canyon, Feb. 28, 1946," is in the American Museum of Natural History, kindly donated by F. H. Rindge. A genitalic slide made from the first-named specimen matches the above-mentioned figure quite closely in the shortness of the inferior branch of the

harpe, and a superficial examination of the other specimens shows the same character. As the suffused maculation of the forewings also coincides with that of the type and the locality is fairly close to the original one, there seems little doubt but that the five specimens may be placed as *inferior*. Based on these, the following more detailed description has been compiled.

The squamation of head, collar, and thorax is very rough, composed of mixed black and whitish scaling and giving a general deep smoky gray appearance with only the faintest tinges of brown visible. The basal portion of the collar is paler, and the darker apical half is crossed by a faint, blackish line followed by a more definite, apical dark band which is slightly tinged with brown. The patagia are paler laterally and are bordered with dark lines, not very obvious against the general dark background of the thoracic scaling. The thoracic and first abdominal tufts are also tipped with black. The abdomen is dull ochreous. The forewings are deep smoky gray with slight tinges of a purplish brown suffusion. There is some difference between the distinctness of the maculation in the male specimens. The one from which the genitalic slide has been made approaches closest to the type in this respect. The cross lines are scarcely traceable, and the confluent orbicular and reniform are only very slightly paler than the ground color, forming the usual broad, open U which is bordered inferiorly by a white line, most distinct on the outer side of the reniform. This line, in turn, is faintly edged with a darker black brown line, and below this the central area of the wing shows the merest trace of brown suffusion; the reniform is also slightly tinged with brown. A faint black brown oblique dash on the costa before the apex indicates the inception of the s.t. line, the usual similar mark before the tornus being practically absent. The subterminal area is very faintly paler than the smoky terminal space, crossing which the veins are slightly darkened, producing a somewhat dentate appearance. The fringes are concolorous with only the merest suggestion of a paler checkering. The hind wings are smoky brown with a thin pale line at the base of the concolorous fringes. Beneath, forewings light smoky, costa palish and with a dark mark at the inception of the t.p. line. Hind wings still paler, sprinkled with smoky atoms and with a large, dark discal spot. Fringes on both wings more distinctly checkered than above. Two males are more definitely marked on the forewings, and in one from the Los Angeles Museum a dark, basal half line

is distinctly visible, attached to the lower end of which is a short, black, basal dash. The irregularly curved t.a. line is marked by blackish in the costal half of the wing. The black inner border of the confluent spots is much more obvious, but the white line, on the other hand, is less noticeable. Dark streaks, broken by pale dots, mark the t.p. line. The dark ante-apical dash is strengthened, and the similar mark at tornus is also to be traced. Beneath, the hind wings show a broad postmedian line, parallel to the outer margin, as well as the usual large discal spot.

Two males from the United States National Museum collected in February at Glendale resemble the Los Angeles material very closely in coloration and maculation of the primaries. However, as far as can be told from an examination of the genitalia *in situ*, the lower fork of the harpe is somewhat longer, and placement as *inferior* will have to be checked further when more material, especially females, is available.

The female possesses certain points of difference from the males in the maculation of the forewings and bears considerable resemblance to a pale *muricina*. The confluent spots are distinctly marked in dull whitish, the reniform with a small dark spot in its lower angle. The surrounding area is rather broadly tinged with brownish, the color of the remainder of the wing being purplish gray. The other maculation is much as in the better-marked male specimens.

ANTENNAE: A slide has been made of the right antenna of the male holotype, and the same three segments as have been figured for other species (viz., segments 21–23) have been illustrated.

The male antenna is in general structure very closely similar to that of *plusiiformis*, but the points of insertion of the individual pectinations on the main shaft are distinctly more medial. The length of a pectination on the outer side in the area figured (farther distad the relative lengths vary somewhat) is slightly less than one-half of the inner pectination. This outer branch appears, in the slide material examined, to be very slightly longer than the corresponding one in *plusiiformis*, but in dried material such difference is scarcely appreciable.

The female antennae are quite characteristic, being definitely bipectinate, resembling in this respect those of *muricina*. As in the male the insertion of the pectinations on the main stalk is below the apical margin of the segment. The inner branch is thin

and pointed, terminating in a single bristle, the outer branch about half the length of the inner one. The whole segment is very finely setose. Compared with *muricina* the pectinations, especially on the inner side, are longer and thinner. The illustration is made from the antenna of the Los Angeles specimen previously mentioned. No other material has been available for study.

MALE GENITALIA: What was left of the genitalia of the holotype after Smith's mutilation has now been mounted in balsam. Parts of the tegumen were found to be broken, and the central portion, including the juxta and anellus, too badly damaged to be usable. The uncus was intact and is, as usual throughout the group, short, broad, and with truncate apical margin. It has been possible also to illustrate the left clasper and its appendages and also the aedeagus. For the sake of comparison a figure of the complete genitalia of a Los Angeles male is offered. It will be noted that there is a slight asymmetry between the two sides, but the short inferior branch of the harpe is quite characteristic and at once separates the species from its allies. In the Los Angeles specimen the harpe proper on the left side is less downcurved than in the corresponding portion of the type specimen, but this probably has little significance as the other parts match very closely. The corona of the cucullus is very weak. The anellus appears to be somewhat distorted, and its obvious difference in the drawing from that of *plusiiformis* should be discounted until more material can be examined. In the aedeagus of the type, as illustrated, the lobes are well separated, and the spining at their apices seems somewhat different to that found in *plusiiformis*. As such spining appears, in any case, a rather variable feature in the allied species, the apparent distinction must be verified, when more material is available, before the character can be used as diagnostic. It has also been noted that in the preparations of both the type and the Los Angeles specimen the strong apical spine of the vesica, present in *plusiiformis*, is missing. This may be due to the fact that it has been injected into the female bursa during copulation; in any case the matter needs further checking. Lack of material has made it impossible to study the female genitalia.

REMARKS: For the present the known range of this species is restricted to the localities mentioned above in Kern and Los Angeles counties, southern California. Further collecting will probably extend the area of distribution considerably.

TYPE: Holotype, male, Havilah, Kern County, California, in the American Museum of Natural History.

Stretchia muricina (Grote)

Acerra muricina GROTE, 1876, Bull. Buffalo Soc. Nat. Sci., vol. 3, p. 85.

Graphiphora muricina, GROTE, 1876, Canadian Ent., vol. 11, p. 27.

Perigrapha muricina, GROTE, 1881, Canadian Ent., vol. 13, p. 133; 1883, Proc. Amer. Phil. Soc., vol. 22, p. 170. SMITH, 1889, Proc. U. S. Natl. Mus., vol. 12, pp. 491, 493, pl. 22, fig. 4 (genitalia).

Stretchia muricina, SMITH, 1893, Bull. U. S. Natl. Mus., no. 44, p. 208. HOLLAND, 1903, Moth book, p. 205, text fig. 115 (type), pl. 25, fig. 5. HAMPSON, 1905, Catalogue of the Lepidoptera Phalaenae in the British Museum, vol. 5, p. 363, pl. 88, fig. 17. DRAUDT, *in* Seitz, 1924, Macrolepidoptera of the world, vol. 7, p. 154, pl. 22a (copy of Hampson).

In the original description Grote states that the name was based on a male specimen, "No. 5999, Oregon, Coll. Mr. Hy. Edwards." Such a specimen exists in the American Museum collection; it does not bear Grote's characteristic type label but a label in Henry Edwards' handwriting, "Perigrapha muricina Gr." It has, however, always been considered by Smith and others as being the actual holotype, and there seems no reason to doubt this procedure, especially as Grote states in the introduction to his paper (p. 77) that "types and determined specimens are returned to Mr. Edwards," and Hampson does not list the type as being present in the British Museum collection. In the Henry Edwards' catalogue the number 5999 gives the further information that the specimen was collected at The Dalles, Oregon, by Edwards in July; the late occurrence of the species is rather odd.

The holotype is worn and possibly somewhat faded. No topotypical material has been examined, but a male in the United States National Museum, *ex* Barnes collection, from Corvallis, Oregon, April 11, matches the type very closely and can be considered as typical. After careful comparisons, it has been decided that a series from southern Vancouver Island, British Columbia, is a very close match with these Oregon males and can, without much doubt, be considered as fairly typical of the species. Male specimens are rather brighter in color than the type but show the characteristic broad, pale, marginal area on the forewings which contrasts quite strongly with the general brown color of the median area on which the pale, usually confluent spots also stand out quite sharply, forming a U mark rather less open than in *plusiiformis* forms. There is little indication of the dark basal

dash found in *plusiiformis*, but a pale spot is present below base of costa, bordered outwardly by a curved dark line and inwardly by traces of the subbasal line. Holland's text figure of the type shows such characters quite clearly, but it is doubtful if his colored figure (pl. 25, fig. 5) represents the species. It looks more like specimens that are now being placed under *coloradicola* Strand. Hampson's figure of a Vancouver male is fairly accurate but too highly and contrastingly colored. A female in the United States National Museum from Victoria, British Columbia, is very similar to the males in coloration. In another single female in the Canadian National Collection collected at Wellington, Vancouver Island, on April 29, 1907, there is a more decided purplish tinge in the ground color of the primaries, notably in the basal and terminal areas; the cross lines are more distinct and the spots are narrowly separated, this latter character being a mere individual variation, as already noted. Both sexes show considerable contrast between the brown-tinged collar and the pale gray patagia.

ANTENNAE: Only the basal half of the right antenna of the holotype was present. This has been mounted in balsam, and a drawing of the ventral side of segments 21 to 23 is given. When compared with the same section of a *plusiiformis* antenna, great similarity is apparent; slight points of differentiation are found in the somewhat greater length of the outer branch in the present species and in the points of insertion of the pectinations on the main stalk which, while not so medial as in *inferior*, are not quite so entirely apical as in *plusiiformis*. Vancouver Island males examined appear to agree in such respects, but the differences are very slight and hard to visualize in dried material.

In the female the antennae are distinctly bipectinate as in *inferior* and thus easily separable from those of *plusiiformis* and *prima*. A drawing of the ventral surface of segments 25 to 27 of the left antenna of the Wellington specimen is given. As compared with the same section of *inferior* it may be noted that the inner branch is slightly thicker and a little shorter; other differences are very slight.

MALE GENITALIA: The genitalia of the type specimen had suffered more severely from Smith's treatment than any of the other species. Only the costa and cucullus of the left clasper remained, the interior armature having been broken off. The tegumen with uncus and vinculum were intact as was the aedeagus, but none of these parts shows any appreciable difference from those

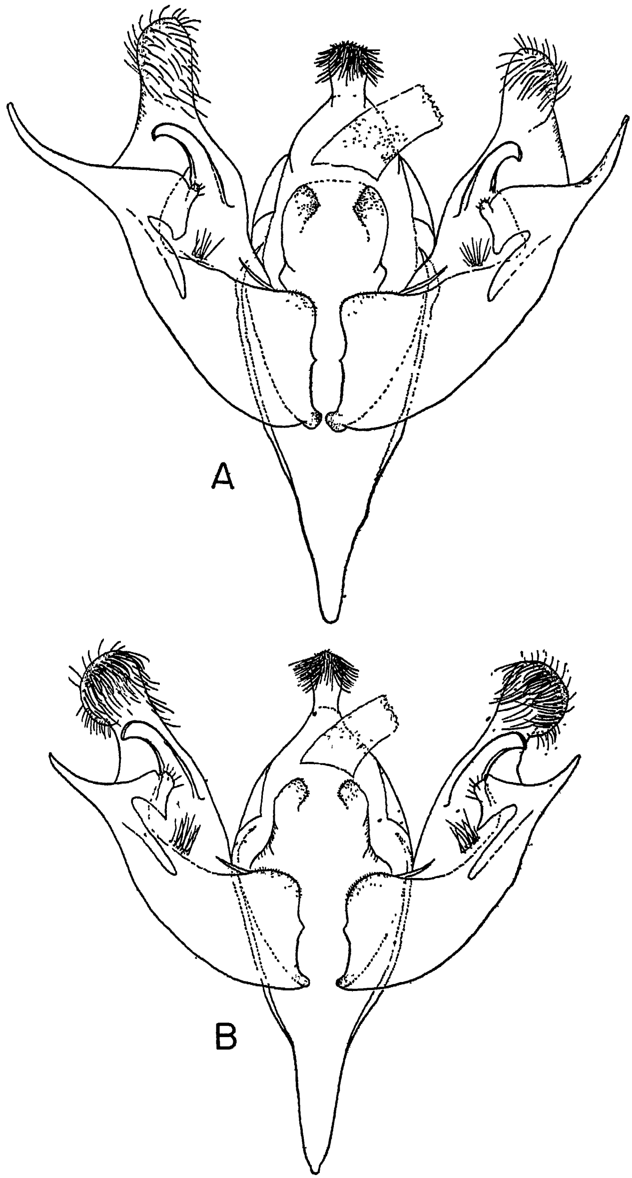

FIG. 4. A. Male genitalia of *Stretchia muricina* (Grote) (Victoria, British Columbia). B. Male genitalia of holotype of *Stretchia pacifica* McDunnough (Inverness, Marin County, California).

of *plusiiformis* as illustrated. A figure is given of the entire organ of a Victoria, British Columbia, specimen; the main differential character being found in the almost entire lack of the neck of the cucullus and the consequent slightly different position of the inner armature of the clasper. This difference seems to be borne out by the remnants of the left clasper of the type, as far as can be judged. In slide preparations that have been opened out the whole clasper also appears more upright than that of *plusiiformis* where a distinct outward bend towards apex is present.

FEMALE GENITALIA: The general type of the genitalia is similar to that of other species. In the single slide that could be examined, and of which a figure is given, it was noted that the ductus bursae was much broader proximally than in *prima* and that the bursa membrane was strongly and closely striated, but whether or not these characters are constant can be determined only when more material is available for study.

REMARKS: As here restricted typical *muricina* would appear to inhabit the low-lying coastal areas of southern British Columbia, northern Oregon, and presumably Washington. Judging by a single male in the United States National Museum labeled "Arrowhead Lake B.C.," its range extends inland in the Canadian province for some distance, but material from this region and from other sections farther east is very scanty and identifications are still doubtful. Certain material, received mostly from the Canadian National Collection, has been tentatively placed under *muricina*, the placement being based largely on the upright characters of the claspers and the bipectinate nature of the female antennae. Two males and a female from Medicine Hat, Alberta, are rather smaller and show a deeper coloration of primaries than found in Vancouver Island specimens, the broad, pale, terminal area being restricted to a narrow subterminal band. In the male genitalia of the single specimen examined the claspers are upright, but there are evidences of a slight neck, and the corona is much heavier. The length of the lower branch of the harpe (the sacculus extension) is somewhat shorter than in the topotypical form, but this is probably individual, as a certain amount of variation has been found to exist in this respect in all the species. The female antennae possess broader, chunkier segments than in the type form, and the branches are thinner and shorter, notably those of the outer side, as may be noted from the illustration. A small female from Waterton Lakes, Alberta, may also fall

here, along with a male in the United States National Museum, *ex* Graef collection, with the possibly erroneous label "Calgary, B.C." in J. Doll's handwriting. A single male in the Sperry collection from "Wallace, Idaho" appears to agree with this latter material. Two males from Lillooet, British Columbia, are very similar to the Medicine Hat specimens but show a deeper brown median area of primaries along with a duller colored terminal section. The male genitalia differ little from those of the Medicine Hat male, the lower branch of the harpe being, however, of normal length. With these two males a single female from Moscow, Idaho, could easily be associated. There is, again, in this specimen a reduction in the length of the antennal branches as compared with those of *muricina*, but, as illustrated, the outer branch is longer than in the Medicine Hat female and almost subequal with the inner one, both being rather thick. Just what value can be assigned to these differences can be determined only when more material is available.

TYPE: Holotype, male, The Dalles, Oregon, in the collection of the American Museum of Natural History.

Stretchia pacifica, new species

A small species evidently closely related to *muricina* and possibly merely a race of this species, occurring in the coastal region of central California. It is treated as a good species on account of its smaller size and certain apparently constant differences in the male genitalic and female antennal structure.

Male antennae bipectinate, closely similar to those of *muricina* but the branches possibly slightly thinner; female antennae with the outer branch shorter than that of *muricina* and both branches thinner. Squamation of palpi and head brownish, that of the head mixed with white scaling; tuft on vertex strong. Collar brown, crossed at apex by a deep brown bar. Thorax and patagia deep gray, latter with a certain admixture of white scales, and with their apices crossed by blackish bars. Primaries quite similar in general appearance to those of *muricina*, the brown tints prevailing over the wing to just beyond the t.p. line, the outer area being noticeably paler with a distinctly concave inner edge. Along the costa, as well as basad of the t.a. line and distad of the t.p. line as narrow bands, the deep purple gray ground color is predominant; the remainder of the basal area and practically the whole median area is suffused with a rather bright brown,

slightly tinged with pinkish. The basal dark half line is present, angled outward on radius; below it is a short, improminent, dark, basal dash, bordered on costal side with pale yellowish (at times obscured by brown). The brown t.a. line is obscure, feebly scalloped and outwardly oblique as in other species. The stigmata are confluent, the orbicular is prominent with its whitish filling, the reniform narrower than usual and largely filled with red brown. The U formed by the confluent stigmata is narrower and more upright than usual; it shows the white and black lower border lines common to all members of the group; the brown shading is very deep in the surrounding area. T.p. line quite improminent and mostly indicated by the dark streaks on the veins on its outer side, these, as usual, interrupted by white dots. A whitish, slightly curved band is a prominent feature of the subterminal area, bordered inwardly at apex and tornus by the customary dark brown streaks. The terminal area is somewhat darker, being shaded with purplish gray, and the dividing line between the two zones has (frequently) a somewhat dentate appearance. A series of thin black terminal lunules. Fringes with the basal half pinkish brown, the apical portion brown, checkered with blackish. Secondaries deep smoky, tinged with pinkish brown basally and with the fringes paler with a slight pinkish tinge. Beneath primaries smoky, tinged with pink in apical portion and with traces of a postmedian dark line; secondaries paler and more decidedly pink with prominent discal spots and postmedian lines. In the single female examined the brown shading of the median area is a deeper and less bright shade than in the male. Expanse 28–30 mm.

TYPE MATERIAL: Holotype, male, Inverness, Marin County, California, March 13, 1947 (W. R. Bauer), in the American Museum of Natural History. Allotype, female, same locality and collector, April 12, 1947, in same collection. Paratypes, one male, same locality and collector, March 5, 1940, and one male, San Antonio Creek, Sonoma County (Bauer), both in Canadian National Collection; one male, Inverness, Marin County, February 16, 1948, and one male, Bodega, Sonoma County, March 18, 1939, both in collection of W. Bauer; one male, Spring Mountain, Sonoma County, March 5, 1940, in collection of O. Buchholz; one male, Bodega, Sonoma County, March 18, 1939 (E. C. Johnston), in United States National Museum.

REMARKS: The male genitalia, as illustrated, are intermediate

between those of *muricina* and *plusiiformis* and show the usual variation, common to the group, in the length of the lower branch of the harpe and the shape of the cucullus; the whole organ is smaller than in either of the other species. The female genitalia approach closer to those of *prima*, as illustrated, than they do to *muricina;* the ductus bursae is even narrower and less expanded proximally than in *prima*, and the bursa shows little of the striations found in *muricina*.

The species would appear to be subject to considerable variation. A slight tendency towards a brownish suffusion in the pale terminal areas in otherwise normal specimens is evident in some of the paratypes. In two males under examination this suffusion has been developed to such an extent as entirely to eliminate the pale areas, and in one of these males smoky shade bands cross the primaries in the antemedian and subterminal areas. In both specimens the confluent stigmata are heavily overclouded. In a third male from Bodega, Sonoma County (in the Canadian National Collection), which on genitalic characters belongs here, the whole of the primaries are deep smoky with nearly all trace of the maculation obliterated. This specimen has the superficial appearance of *inferior*.

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NEW OR UNUSUAL MEXICAN AMPHIBIANS

By Edward H. Taylor[1]

An examination of several small Mexican herpetological collections, received at various times during the past five years by the American Museum of Natural History from Mr. Thomas C. MacDougall, disclosed the presence of certain rare species and certain presumed new species of salamanders and frogs. With his characteristic generosity Mr. Charles M. Bogert, Chairman and Curator of the Department of Amphibians and Reptiles, has forwarded these to me with the request that I study the lot and describe the new forms.

The source of most of these collections is the little-known mountainous areas of southern Oaxaca; however, one species here described, *Thorius minutissimus*, is from Cerro Humo, which lies in the northern part of the state. The mountains of southern Oaxaca are divided into two unequal masses by the intervention of the low land of the Isthmus of Tehuantepec with elevations of less than 2000 feet. The area lying in the southeastern part of the state, with reported elevations of 7900 feet, marks the beginning of the coastal ranges of the Pacific side of Chiapas and Central America. That in southern and western Oaxaca is very much the larger and higher, an elevation of 10,299 feet having been reported. This mass is similarly isolated by relatively low land from the high ranges of Guerrero lying to the west and largely surrounded by the Balsas basin, and in which elevations above 12,000 feet occur. Maximum elevation of the connecting land between the two masses is between 2000 and 3000 feet.

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Because of the isolation of these various mountain masses it is not surprising that some novelties have been encountered. It is strongly probable that explorations at still higher elevations will yield even a greater number of unknown species.

The few collectors who have penetrated these areas of southern Oaxaca and southeastern Oaxaca have discovered several important amphibian species, among which may be mentioned *Diaglena reticulata* Taylor, captured by MacDougall previously, and *Magnadigita macrinii* (Lafrentz), collected by the describer, Dr. K. Lafrentz. It is also quite probable that it was in these areas that such Mexican species of unknown specific locality as *Hyla plicata* Brocchi, *Cauphias crassum* Brocchi, and *Spelerpes sulcatum* Brocchi were collected—species that have eluded collectors during the 75 years since their original discovery.

In this paper I am describing as new two diminutive species of the salamander genus *Thorius* and two frogs, one in the genus *Ptychohyla* and one in the genus *Plectrohyla*. Comments are made on the following known species: *Pseudoeurycea cochranae* (Taylor), *Magnadigita macrinii* (Lafrentz), *Hyla loquax* Gaige and Stuart, and *Centrolenella viridissima* Taylor.

I wish to acknowledge my indebtedness to Mr. Charles M. Bogert and Mrs. Bessie Matalas Hecht for the privilege of studying these specimens. I am obligated to Dr. Norman Hartweg and Dr. Charles F. Walker for the loan of certain species of *Plectrohyla* with which I have compared the species herein described. All of the recognized species of this genus have been examined in this study.

Pseudoeurycea cochranae (Taylor)

Bolitoglossa cochranae TAYLOR, 1943, Univ. Kansas Sci. Bull., vol. 29, pp. 343–345 (type locality, Cerro San Felipe, Oaxaca, Mexico).

Pseudoeurycea cochranae, TAYLOR, 1944, Univ. Kansas Sci. Bull., vol. 30, p. 209.

A single specimen, A.M.N.H. No. 51821, is referred to this species. It was collected along with three specimens of *Magnadigita macrinii* (Lafrentz) at Quiegolani, Oaxaca, by Thomas C. MacDougall, in 1944. This is the first collection of the species at a place other than the type locality, and it extends the known range approximately 75 miles to the south.

The specimen has been compared directly with the type, and, while certain apparent differences were noted, it is believed that all of them are traceable to the character of the preservation and are

not actual. The specimen is much darkened, but when submerged in water the light markings can be seen. The tail is missing. However, all the characters that are diagnostic of the species can be discerned save those involving the tail.

Magnadigita macrinii (Lafrentz)

Oedipus macrinii LAFRENTZ, 1930, Abhandl. Ber. Mus. für Naturk. u. Heimatk. Naturwiss. Ver. Magdeburg, vol. 6, no. 2, pp. 150–152 (type locality, "Cerro Espino, 1000 m hoch, subtropischer Laubwald am Südhang der Sierra Madre del Sur, bei Concordia, Staat Oaxaca, Mexiko").

Bolitoglossa macrinii, TAYLOR, 1941, Herpetologica, vol. 2, p. 65.

Magnadigita macrinii, TAYLOR, 1944, Univ. Kansas Sci. Bull., vol. 30, p. 218.

Since the discovery of this species by K. Lafrentz in Oaxaca in 1927, no specimens, so far as I know, have reached collections save the three here recorded (A.M.N.H. Nos. 51822–51824). These were collected at Quiegolani, Oaxaca, by Thomas C. MacDougall in 1944. Since the original description omits numerous characters I am presenting data on these specimens.

To the following table of measurements I append for comparison such measurements of the type and two paratypes as have been published.

TABLE 1

MEASUREMENTS, IN MILLIMETERS, OF *Magnadigita macrinii* (LAFRENTZ)

A.M.N.H. Numbers	Sex	Snout to Vent	Tail	Snout to Arm	Axilla to Groin	Arm	Leg	Head Width	Head to Gular Fold
51822	♀	52	(38)[a]	17.2	29.0	12.2	13.2	9.0	13.0
51823	♂	69	70	22.5	37.0	16.7	18.0	10.9	16.2
51824	♀	73	(42)[a]	22.0	38.5	17.0	18.0	12.0	15.2
Type	♂	50	47	—	—	—	—	8.5	12.0
Paratype	♀	64	58	—	—	—	—	11.5	12.5
Paratype	♂	69	72.5	—	—	—	—	—	15.0

[a] Regenerated.

The maxillary teeth of this species are small and have a tendency to grow upward towards the palate rather than down in the normal manner. The vomerine teeth are somewhat irregular. In the two females there is a tendency for the teeth to be arranged in two rows in each group, while in the large male the teeth are fewer and are arranged in a single curving row. The series begin beyond the outer level of the choanae and curve in and back. Mesially they

are separated by a space equivalent to twice that between two teeth in one; four times, in the other two. The vomerine teeth are separated from the paravomerine teeth by a variable distance —in one specimen the space is equal to that between the vomerine series; in another, four times the distance between them. In all cases the paravomerine teeth form a large single group, greatly widened posteriorly and somewhat notched behind.

TABLE 2

DENTAL CHARACTERS OF *Magnadigita macrinii* (LAFRENTZ)

A.M.N.H. Numbers	Sex	Maxillary Teeth	Mandibular Teeth	Vomerine Teeth	Paravomerine Teeth	Premaxillary Teeth
51822	♀	16–17	34–32	18–17	In single group	4–4
51823	♂	17–18	41–40	15–14	In single group	9
51824	♀	28–30	32–34	20–19	In single group	10

There is no trace of a sublingual fold. The choanae are moderately large, separated from each other by a space equal to 5.5 times the diameter of one. The diameter of the eye is about .5 mm. less than the length of the snout. Twelve costal grooves are present (or 13 if one counts a groove in the groin).

Another striking character of this form is the absence of the mental gland in the male. The constriction of the tail is more marked than in other species of the genus, since the base of the tail suddenly widens behind the constriction. Lafrentz (*loc. cit.*) mentions one of the paratypes as having a tail as wide as the body, at its base. When the limbs are adpressed they are separated by two costal folds. The cartilages on the side of the neck form lateral elevations that extend above and behind the arm insertion to the second costal groove. The costal grooves can be traced across the belly, and dorsally almost to the middorsal line. The skin on the costal folds is usually longitudinally wrinkled. The cloacal region of the male is distinctly papillate over the greater part of the lateral walls; in the female the lateral folds are confined to the anterior part of the cloaca only.

The types are described as showing silvery flecks on the sides of body and tail. The American Museum specimens, probably long preserved in formalin, show no such markings but are shiny black above, becoming a little lighter on the ventral surfaces, the smallest specimen being somewhat the lightest. Silvery marks such as those described in the type are present on the venter and sides of certain

Pseudoeurycea cephalica manni (Taylor), a black form from more northern parts of Mexico. These silvery marks often completely disappear from preserved specimens of the species. Hence, I am presuming that these specimens of *macrinii* may likewise have had the expected typical markings when alive.

In various forms of salamanders the premaxillary teeth of the adult male penetrate the upper lip and are visible when the mouth is closed. In this form, however, the premaxillary teeth remain in the same normal position in the jaw as occurs in females of the species.

Thorius minutissimus, new species

HOLOTYPE: A.M.N.H. No. 52673, adult female, collected at Santo Tomás Tecpan, Oaxaca, Mexico, March 3, 1946, by Thomas C. MacDougall.

PARATYPES: A.M.N.H. Nos. 52674, 53930–53932, collected with the type by the same collector; University of Illinois Museum, Nos. 3754–3759, same locality and collector.

DEFINITION: A diminutive species, the greatest snout-to-vent length, 22 mm.; greatest total length, 47.5 mm.; head width (3.3 mm.) in snout-to-vent length, 6.6 times. Snout rather bluntly narrowed; fifth toe greatly reduced or absent; adpressed limbs separated by 6.3 folds. Eyelid black, contrasting strongly with brown dorsal coloration of head.

DESCRIPTION OF THE TYPE: The width of head contained in snout-to-vent length 6.6 times; head length to gular fold (measured at median ventral point) contained in this distance 4.9 times; width of the eyelids slightly less than distance between orbits; length of eye about a fourth longer than snout; nostril large, oval, diagonally placed, its greatest diameter greater than its distance from lip edge, and greater than its distance from eye; distance between nostrils about 1.7 times diameter of a nostril; orbitolabial groove runs below eye and bisects lip on a level with back edge of eye.

A deep groove begins at upper level of eye, runs down and across jaw angle and throat to opposite side; an obsolescent arched groove rests on this groove as a base, extending forward; a strong gular fold across throat, curving forward; from ends of this fold nuchal folds arise and pass up on sides of neck to levet of upper part of eye but fail to reach dorsal median line; a shorl groove from eye runs diagonally upward but does not reach first

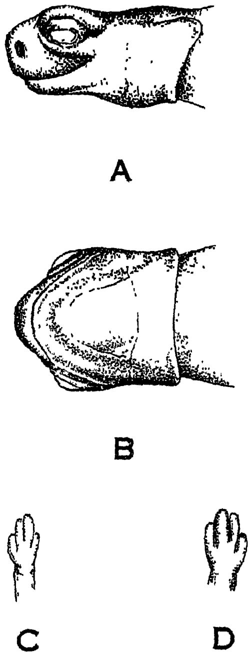

FIG. 1. *Thorius minutissimus,* new species. Type, A.M.N.H. No. 52673; adult female. Santo Tomás Tecpan, Oaxaca, Mexico. A. Lateral view of head. B. Ventral view of head. C. Hand. D. Foot. All about × 5.6, somewhat diagrammatic.

transverse groove. Snout narrowed anteriorly and rather bluntly pointed. A strong sublingual fold present, slightly free anteriorly; tongue free; no maxillary teeth present; no premaxillary teeth discernible in type (present in males); about six vomerine teeth on a transverse ridge; choanae minute and of no greater diameter than diameter of grooves which run from them; teeth present on mandible; paravomerine teeth in a single large group, well separated from vomerine teeth; lateral cartilages on sides of neck form folds extending only as far as arm insertion.

Skin generally smooth but somewhat pitted on head; entire body covered with minute circular glands save on eyelids and areas about arm and leg insertion, the individual glands not only proportionally but actually larger than those in *Thorius narisovalis* Taylor, the largest species of the genus (in any given surface measurement individual glands less numerous); 14 costal grooves,

counting one each in groin and axilla, but last costal fold very narrow, not traceable across venter; about 29 caudal grooves on tail; caudal constriction dimly indicated; tail (somewhat shrunken) definitely quadrangular in cross section; arm length equivalent to length of 3 $^3/_4$ costal folds, the leg to 3 $^1/_2$ costal folds; when adpressed along body, arm and leg separated by about 6 $^1/_3$ costal folds.

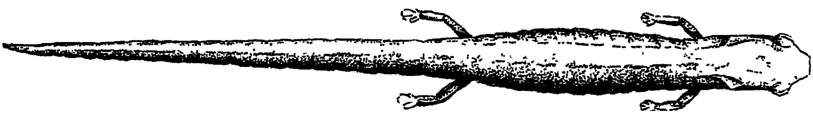

FIG. 2. *Thorius minutissimus*, new species. Type, A.M.N.H. No. 52673; adult female. Dorsal view of body. × 2.52, somewhat diagrammatic.

Hand with two middle fingers somewhat spatulate but grown together save at tips, each outer finger completely fused with adjoining digit; apparently only four toes (some trace of fifth in certain paratypes); two middle toes large, somewhat spatulate, their tips free, somewhat rounded; outer toes on each side fused to inner.

COLOR: A broad median stripe of brown extending from snout to some distance on tail; sides a distinctly darker shade of brown; venter lighter than dorsum, with a few rosette-like light spots on chin and throat; upper eyelid blackish. Under a lens the coloration is seen to consist of rounded fawn-colored areas with a reticulation of dark brown or blackish pigment; areas about arm and leg insertion lighter; a light area on under side of legs, and a very indistinct lighter glandular spot behind leg insertion.

TABLE 3

MEASUREMENTS, IN MILLIMETERS, OF TYPE AND PARATYPES OF *Thorius minutissimus*

A.M.N.H. Numbers	Sex	Snout to Vent	Tail	Total	Width of Head	Head Length to Lateral Nuchal Fold	Axilla to Groin
52673	♀	22.0	24	46.0	3.3	4.5	12.3
52674	♀	22.0	23	45.0	3.2	4.6	12.8
53930	♀	21.5	26	47.5	3.0	4.5	11.0
53931	♀	20.5	(4)[a]	(24.5)	2.8	4.5	11.2
53932	♂	19.0	20	39.0	2 7	4.4	10.7

[a] Regenerated.

VARIATION: The small outer toe, which appears to be absent in the type, is more or less evident in certain of the paratypes and seems best developed in the smallest specimen.

The single male specimen shows a larger subnarial swelling than the females do. The paratypic females have premaxillary teeth. The two premaxillary teeth have barely penetrated the upper gum. The females have lamellate folds on the cloacal walls, while in the male these walls are papillate. The male has a large mental gland. That the series is adult is evidenced by the fact that the three larger females contain ovarian eggs. In one that was opened, five eggs were counted.

REMARKS: In size this species is scarcely larger than *Thorius pennatulus* Cope. Geographically, and structurally as regards the character of the nostril, it appears to be related to *Thorius narvisovalis* Taylor which occurs in the high mountains of central Oaxaca (Cerro San Luis and Cerro San Felipe) near the city of Oaxaca. The latter species is, however, much larger and has a longer tail. In it the eyelids are not darker than the rest of the head; the tail has 35 grooves. The second and fourth toes are more equally developed.

The last costal fold is partially divided (sometimes almost completely so), leaving a narrow fold between this and the groin. Thus 14 grooves may be counted. It may be more correct to ignore this and count only 13 grooves and 12 costal folds.

All the specimens are hardened so that the measurements given are only close approximations. Some of the characters have been difficult to determine accurately for the same reason.

Thorius macdougalli, new species

TYPE: A.M.N.H. No. 52136, collected on Cerro de Humo, Maquiltianguis, Oaxaca, Mexico, by Thomas C. MacDougall, March 2, 1945.

PARATYPES: A.M.N.H. Nos. 53907–53929, taken with the type by the same collector.

DIAGNOSIS: Related to *Thorius pulmonaris* Taylor in having an elongate oval nostril but differs in having a relatively shorter tail (about equal to head-body length rather than $1\,{}^{1}/_{3}$ times body length); 25 caudal grooves, instead of 35 to 38, in adults. Area between eye and nostril a rounded diagonal ridge, giving the canthus a strongly notched appearance; a slight median depression on snout between the swollen areas about nostrils.

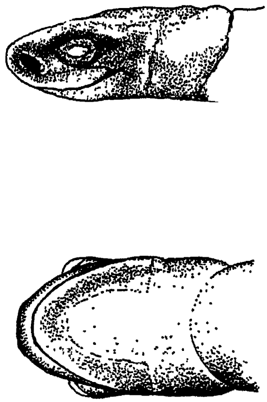

FIG. 3. *Thorius macdougalli*, new species. Type, A.M.N.H. No. 52136; adult female. Cerro de Humo, Maquiltianguis, Oaxaca, Mexico. A. Lateral view of head. B. Ventral view of head. C. Hand. D. Foot. All about × 6.4, somewhat diagrammatic.

DESCRIPTION OF THE TYPE: Head bluntly pointed, the eye length equal or nearly equal to snout length; height of the snout slightly greater than its length; eyelid (.7 mm.) in interorbital width (1.1 mm.) about 1.5 times; a strong orbitolabial groove from below upper anterior corner of eye to a point somewhat behind posterior level of eye, where it bisects the lip; line of mouth somewhat angular below posterior corner of eye, and below subnarial swelling under nostril; nostril very large, elongate-oval in shape, placed diagonally, its greatest diameter about .65 mm.; greatest width of head, 2.5 mm.; distance between nostrils (.72 mm.) a little more than diameter of a nostril; small swelling below nostril not pendent; nasolabial groove runs straight down to near lip border, then turns directly posteriorly on subnarial swelling.

A strongly developed gular fold crosses neck, curving forward; from its lateral ends deep nuchal grooves pass up on sides of the

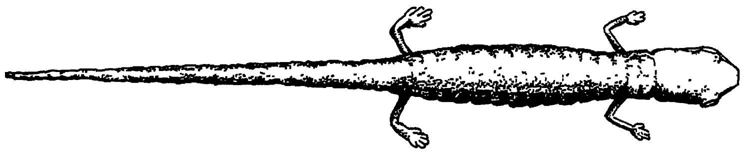

FIG. 4. *Thorius macdougalli*, new species. Type, A.M.N.H. No. 52136; adult female. Dorsal view of body. About × 2.4, somewhat diagrammatic.

neck and tend to join on the dorsal nuchal line; a sinuous groove crosses throat and jaw angle and passes up on sides of head to level of eye on dorsal surface of head; a small groove runs back from posterior corner of eyes, but posterior ends of eyelids are not tucked under it; an arched groove rests on anterior chin groove, its apex directed forward; no longitudinal grooves running back from eye to the vertical nuchal groove (or if present, cannot be discerned in the type).

Vomerine teeth 2–3 on a high transverse ridge, the two series narrowly separated mesially; vomerine teeth separated from paravomerine teeth by a distance equal to entire vomerine series; no maxillary teeth present; a single median premaxillary tooth (males usually with two teeth piercing lips); paravomerine teeth in a single large patch, not, or scarcely, notched behind; a distinct sublingual fold present; choanae distinctly wider than grooves that pass out from their sides, the distance between them equal to about 2 $^1/_2$ times diameter of one choana.

Limbs small, when adpressed, the digits separated by 5 $^1/_2$ or 6 costal folds; most of outer phalanx of each of the two middle fingers free; two outer fingers not, or with but a very meager part, free from membrane; distal phalanx and occasionally part of second phalanx free on three middle toes; outer toes not free, or with only extreme tip free; middle digits are slightly spatulate, the tips more or less rounded (rather pointed in *T. pulmonaris*).

Body with 13 costal grooves, tail with 25 vertical grooves. The grooves cross venter and can be traced to near median dorsal line; a moderately distinct caudal constriction immediately following elongate cloacal opening; glandular light spot behind leg insertion distinct; skin generally smooth, but dorsal surface of head showing a finely corrugated, pitted surface; a diamond-shaped area in the occipital region more or less distinctly elevated.

COLOR: Dorsal surface very dark brown; sides blackish, gradually merging into the brown ventral coloration; subnarial

swellings grayish, and under side of chin with numerous small cream flecks that also occur sparsely, low on sides; tips of digits colored like foot and hand; under a lens individual ventral glands appear as minute rounded cream spots in a dark reticulation in which minute lighter lines are visible.

MEASUREMENTS (IN MM.): Snout to vent, 20.7; tail, 20.9; width of head, 2.5; length of head to the gular fold (median), 3.9; arm, 3.5; leg, 4.0; axilla to groin, 10.5; tip of snout to arm insertion, 11.3.

VARIATION: The major differences between the sexes are as follows: The males are somewhat smaller, their legs proportionally longer and separated by 4 $^1/_2$ to 5 folds only. The digits themselves are apparently slightly more slender. The mental gland is very conspicuous, the gland itself being yellow in color and occupying one-third of the distance from tip of the chin to the gular fold. The swellings below the nostrils are proportionally larger. The two premaxillary teeth in the male are especially large, piercing the upper lip and curving down. It is doubtful that any other salamander has proportionally larger premaxillary teeth. Occasionally only a single tooth is discernible, the other being apparently lost. The subnarial swelling is much larger than in the females, and slightly pendent. The nostril is apparently proportionally larger. The largest male among the paratypes measures 18 mm. from snout to vent.

REMARKS: The type is a female carrying eggs in the oviducts. A female paratype of about the same size as the type was opened and five eggs were counted. The type is carrying a plug in the cloaca which appears to be a spermotheca; similar plugs are present in certain other females. In these specimens the cloacal lips are much swollen and wrinkled. The normal cloaca of the female has the anterior part covered with folds; in the males the walls are somewhat papillate, without folds.

The chief distinction between this form and its nearest congener, *Thorius pulmonaris*, may be expressed in the following table:

pulmonaris	*macdougalli*
Larger, maximum snout to vent, 27.5 mm.	Smaller, maximum snout to vent, 21 mm.
Tip of digits cream colored, rather pointed	Digit tip not cream but colored like foot and definitely rounded
Tail longer, $1^1/_2$ times head-body length	Tail shorter, about equal to head-body length
Caudal grooves 35–38 in adults	Caudal grooves 23–25 in adults

Female, premaxillary teeth 4	Female, premaxillary teeth 1 or 2, small
Male, premaxillary teeth 3–4, not piercing lip, not visible externally	Male, premaxillary teeth 2, greatly elongated, piercing lip, visible externally
Mental gland indistinct	Mental gland very large, prominent

The species is named for Mr. Thomas C. MacDougall, the discoverer of this form, who has contributed much to our knowledge of the southern Oaxacan region in Mexico.

Hyla loquax Gaige and Stuart

Hyla loquax Gaige and Stuart, 1934, Occas. Papers Mus. Univ. Michigan, no. 281, pp. 1–3 (type locality, Ixpuc Aguada, north of La Libertad, El Petén, Guatemala).

? *Hyla stadelmani* Schmidt, 1936, Proc. Biol. Soc. Washington, vol. 49, p. 45 (type locality, Subirana Valley, 2800 feet altitude, Yoro, Honduras).

A specimen in poor condition, A.M.N.H. No. 52662, female, acquired by Thomas C. MacDougall at Río Chicapa (near El Altravesado, 1600 feet), Oaxaca, January 7, 1946, is referred to this species. The record extends the known range of the species some 300 miles to the west of Piedras Negras on the Guatemala border of Chiapas, hitherto the northernmost point known.

Some of the characters are obscured by faulty preservation, but all structural characters that can be discerned agree with those of paratypes with which the specimen was compared. The specimen has two large, deep brown, irregular blotches on the back. This is not a usual marking on northern specimens, but a specimen so marked is recorded along with the type description (*loc. cit.*).

In examining the types of *Hyla stadelmani* Schmidt, I was impressed by the strong similarity of that species to *Hyla loquax*. I suspect that a direct comparison of the types will prove beyond question that they are specifically identical. The type description of *loquax* fails to mention the presence of a considerable axillary web in the type.

Hyla loquax is not uncommon in Costa Rica. A large series of well-preserved specimens from Turrialba, Costa Rica, do not differ specifically from a paratype of *Hyla loquax* with which they were compared.

Centrolenella viridissima Taylor

Centrolenella viridissima Taylor, 1942, Univ. Kansas Sci. Bull., vol. 28, pp. 75–77, pl. 9, figs. 2, 2a-b (type locality, Agua del Obispo, Guerrero, Mexico).

The single specimen (A.M.N.H. No. 51846) of this species in the collection is from Río Grande, Tehuantepec, Oaxaca. This is the second locality where the species is known to occur, the type locality being in southern Guerrero, Mexico. The specimen agrees with the type in the following characters: the character and position of large vocal slits; absence of vomerine teeth; the granular character of skin on most dorsal surfaces, less pronounced on middorsal region of body; traces of indistinct lighter dorsal spots (now almost completely disappeared from type); an ample anal flap and two distinct transverse postanal glandular elevations; tympanum covered with granular skin and more or less of its outline discernible; no trace of a humeral cartilage; a strongly defined dermal fold under forearm; two outer fingers nearly half webbed, but only a remnant between other digits; the first and second fingers of about equal length; and tibiotarsal articulation reaching to tip of snout.

The following differences are of no great magnitude and may be of small significance: the toes very slightly narrower and head about one-eighth wider at its widest point, although the snout-to-vent measurement is practically the same; eyes a trifle larger; eyes, seen from above, extending slightly beyond the outline of head (in the figure of the type, the head is shown slightly wider than natural, and the dark color of the eyeball showing through the upper eyelid is emphasized possibly a little too much); fingers very slightly longer. The purplish chromatophores are a trifle larger than in the type.

MEASUREMENTS (IN MM.): Total length, 23.8; length of leg, 43.0; width of head, 9.6.

Centrolenella fleischmannii, also occurring in Mexico, differs in having the second finger much shorter than the first. A white area is present on the eyelids. The leg is distinctly longer, the tibiotarsal joint reaching 2 to 3 mm. beyond the snout tip.

Ptychohyla bogerti, new species

HOLOTYPE: A.M.N.H. No. 51847, collected at Río Grande, Oaxaca, Mexico, by Thomas C. MacDougall, January 21–27, 1944.

PARATYPE: A.M.N.H. No. 51848, taken with the type, same date and collector.

DEFINITION: A small hylid (largest snout-to-vent measurement of males, 32 mm.) with a large lateral gland occupying nearly half the lateral area between axilla and groin; first finger strongly

opposable; outer fingers about one-third webbed; toes four-fifths webbed; pads on fingers equal to, or minutely larger than, tympanum; canthus rostralis sharp.

DESCRIPTION OF THE TYPE: Head slightly wider than body; eyes small, the length of eye equal to distance between eye and nostril, but not so long as snout; nostril equally distant from eye and from median notch in lip; distance between nostrils equivalent to distance between eye and nostril; diameter of tympanum contained in length of eye opening $2\,^1/_6$ times; the distance of tympanum from eye equal to its own diameter; width of an eyelid contained in interorbital distance about $1\,^1/_3$ times; canthus rostralis distinct, angular, the upper part of lores nearly vertical,

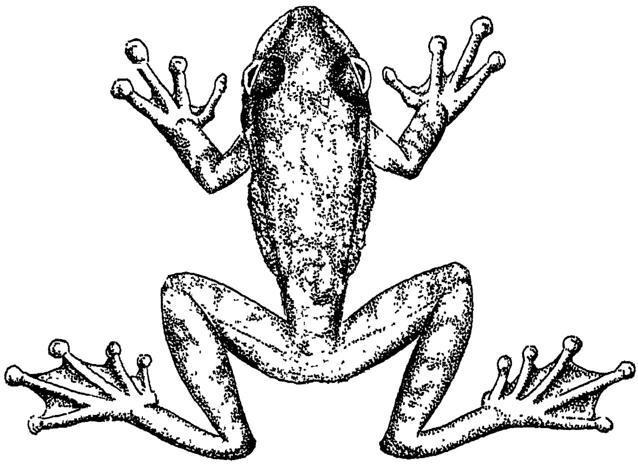

FIG. 5. *Ptychohyla bogerti*, new species. Type, A.M.N.H. No. 51847. Río Grande, Oaxaca, Mexico. Dorsal view. × 1.6, somewhat diagrammatic.

the lower part sloping to lip with a slightly concave area behind nostril; the nostrils distinctly back from end of snout and the area about them slightly swollen, leaving a slight depression between them on snout; supratympanic skin fold from eye runs straight back some distance behind tympanum, then curves down towards arm insertion.

Choanae rather large, separated from each other by a distance nearly three times the greatest diameter of a choana; vomerine teeth in two small elevated fascicles directly between the much larger choanae, and separated from them and from each other by a distance about equal to the length of a single group; two teeth

on each elevation; palatal glands open into a single continuous sinuous groove, which crosses the palate in front of choanae; tongue slightly emarginate behind, about one-fourth longer than wide (in the paratype, tongue subcircular and as long as wide); vocal slits are present.

A very small axillary web evident when arms are placed at right angles to body; upper arm moderately thin; a continuous fold under forearm; finger disks about size of tympanum; first finger strongly opposed to three outer fingers; a very small group of very small nuptial asperities not, or scarcely, touching the large tubercle on base of first finger, lacking brown horny spicules; three outer fingers about one-third webbed, inner fingers about one-fourth webbed; first finger very much shorter than second; distal subarticular tubercle on fourth finger double, on third finger at least bifid. Toes about three-fourths webbed, the web reaching the distal subarticular tubercle of the fourth toe; an elevated inner metatarsal tubercle; a small indistinct outer tubercle; tarsal fold not, or only indistinctly, indicated.

Skin above generally smooth; under a lens a minute corrugation or roughness is evident; skin tends to form two lateral folds but these are impermanent; skin of sides smooth save for a large gland extending half the length from axilla to groin, and about 5 mm. wide, the glandular surface distinctly corrugated. Abdomen and much of ventral and lower posterior surface of thigh strongly granular or areolate; breast and to some extent the chin with granules much less distinct or in places absent; small tubercle or ridge on heel; the tibiotarsal articulation reaches a little beyond the tip of the snout; knee and elbow overlap when limbs are bent along side of body; a small anal flap followed by a distinct groove, the tubercles adjacent not especially differentiated.

COLOR (IN PRESERVATIVE): Above light brown or tan, clouded or spotted with darker brown without definite pattern; limbs irregularly spotted or barred; lateral gland dark brown; groin light, with a few small rounded brown spots also visible on the glands; ventral surfaces uniform light without pigment but with very numerous minute inclusions somewhat yellowish in appearance suggesting minute oil droplets; dorsal and posterior part of thigh pigmented; a broken light line present across anal flap; an indefinite light line, more or less clouded, borders edge of upper lip but no trace of a light spot below eye; under side of tarsus and foot and palm of hand with pigment.

MEASUREMENTS (IN MM.): Snout to vent, 30.0; width of head, 10.5; length of head, 11.0; arm, 18.2; leg, 48.0; tibia, 17.0; foot, 20.3.

VARIATION: The single paratype differs but little in structural characters, but the whole dorsal surface is much darker brown with blackish indefinite spots or clouding. On the ventral surface the chin and throat are flecked with brown, and there is a slight distribution of pigment on the thighs. The under side of the tarsus, hand, and foot is strongly pigmented. The spots in the groin are less discrete. As in the type the first finger is very strongly opposed to the other digits, and the head proportions are about the same.

The minute inclusions of the ventral skin are extremely numerous, but here they are whitish rather than yellowish. The large lateral gland is developed as in the type. The measurements (in mm.) are: snout to vent, 32.6; width of head, 11.4; length of head, 12.2; arm, 19.0; leg, 50.5; tibia, 17.4; foot, 21.4.

REMARKS: This species differs from *Ptychohyla adipoventris* Taylor in that the position of the large glandular area is lateral rather than lateroventral, and the nuptial asperities are distinctly smaller and not horn covered. That species has a somewhat shorter, more angular snout, the nostrils being distinctly farther forward. The tympanum is somewhat smaller, and the leg is shorter proportionally, reaching only to the anterior edge of eye rather than to the tip of the snout as is the case with *bogerti*. It is possible that the horny spicules of the nuptial asperities have been lost in these specimens if they have ever been present.[1]

The species is named for Mr. Charles M. Bogert, Chairman and Curator of the Department of Amphibians and Reptiles at the American Museum.

Plectrohyla brachycephala, new species

HOLOTYPE: A.M.N.H. No. 53761, collected "on a tributary of the Río Ostuta, at the foot of the Sierra Madre between Sierra Madre and Cerro Atravesado," Oaxaca, Mexico, by Thomas C. MacDougall, 1948.

PARATYPES: A.M.N.H. Nos. 53758–53760, topotypes collected with the type by the same collector.

DEFINITION: A *Plectrohyla* with short head, a simple spine on

[1] This may be a seasonal condition.

the pollex, smooth dorsal skin, concealed tympanum, a distinct inner tarsal fold but no outer; vomerine tooth groups separated widely, closer to choanae than to each other; snout very short, rounded, its elevation at nostril greater than its length; normally no double or bifid subarticular tubercles; chin and vocal sac granular; posterior edge of anal flap continuous with a lateral glandular fold curving down; a loreal black line, continued behind eye to arm.

DESCRIPTION OF THE TYPE: Length of head (12.5 mm.) distinctly less than width (15 mm.); length of snout (3.5 mm.) smaller than eye length (4.5 mm.); width of an eyelid (2.7 mm.) in interorbital distance (4.4 mm.) about 1.6 times; canthus distinct but rounded; elevation of snout at nostril (4.4 mm.) distinctly greater than snout length; nostril closer to eye than to

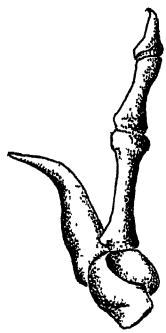

FIG. 6. *Plectrohyla brachycephala*, new species. Paratype, A.M.N.H. No. 53759; adult male. On tributary of Río Ostuta, at foot of Sierra Madre, between Sierra Madre and Sierra Atravesado, Oaxaca, Mexico. Spine of pollex and phalanges of first finger (greatly enlarged, and somewhat diagrammatic).

the median point of upper lip. Tympanum concealed under skin (if skin is shrivelled a little the outline of the tympanum can be seen); slight swellings about nostrils with a discernible depression between.

Vomerine teeth on two small elevated areas between the large choanae, the tooth groups nearer choanae than to each other. Choanae large, separated from each other by a space equal to $3\,{}^{1}/_{3}$ times the diameter of one; groups of vomerine teeth lie between choanae, a little more than half size of choanae, but distinctly closer to choanae than to each other; tongue subcircular, as long as wide, not, or but faintly, emarginate behind, not free;

vocal slits elongate, openings close to mandibular bone; fingers with a web remnant (one-fifth or less); disks on fingers large, that of fourth finger 2.4 mm. wide; that of first finger about half as wide; a well-developed pollical rudiment free for more than 1 mm., with the terminal part of the spine exposed; subarticular tubercles all single; a series of four or five light-tipped tubercles on under side of forearm.

Leg rather short, the tibiotarsal joint reaching eye or slightly farther; two outer toes two-thirds webbed; inner toes from one-half to one-third webbed; disks smaller than those on fingers; a strong, elevated tarsal fold extending four-fifths of tarsus; a rather large, elevated, inner metatarsal tubercle; a small indistinct outer tubercle; skin on under side of foot smooth, the supernumerary tubercles low, rather indistinct.

Skin of back generally smooth with a few indistinct tubercles chiefly over the eye, on rump, and along sides of venter; breast, under thighs, vocal sac, and to a lesser extent the chin, strongly granular or areolate. Anal flap rather small, its posterior edge continuous with a transverse skin fold; under posterior edge of the flap two swollen areas present separated by a deep groove; behind these a pair of somewhat larger tubercles, each with a white summit; a few other tubercles in this area bear white flecks.

COLOR: The type is nearly uniform dark gray with some indistinct clouding; a few indefinite darker marks on limbs and numerous minute whitish or silver flecks; a narrow black line begins on front surface of snout, runs through nostril to eye; a curving black line from eye back along the supratympanic fold to near insertion of arm; a dark area in axilla and scattered small, black brown spots along side in groin. Chin and vocal sac dark blackish; entire venter and under side of limbs strongly pigmented, but lighter than chin; under side of limbs, palm, and sole dark except for some light marks on under side of tibia.

MEASUREMENTS (IN MM.): Snout to vent, 35.0; width of head, 16.0; length of head, 13.2; femur, 18.0; tibia, 19.0; tarsus, 12.0; foot, 14.0.

VARIATION: The three paratypes agree in pertinent characters with the type. All are lighter in color, the backs displaying varying shades of brownish gray with some darker clouding. In two, the dark line on the side of head and neck is distinct; in one, very indistinct as in the type. The series of black brown spots on the sides and in the groin are very distinct in all. Two have spots on

the rump, and one has the lower part of the leg speckled black. All three have much lighter ventral surfaces. The one having the darkest chin has each granule light or whitish at its summit. One specimen has the lower edge of the dorsal coloration indefinite silvery white. The upper lip in this specimen and the loreal regions are clouded indefinitely darker and lighter. This specimen has the dorsal skin with small tubercles or pustules on back and head. Such variations as exist in body proportions may be expressed as in table 4.

TABLE 4

MEASUREMENTS, IN MILLIMETERS,[a] OF THE TYPE AND PARATYPES OF *Plectrohyla brachycephala*

A.M.N.H. Numbers	Snout to Vent	Head Width	Head Length	Femur	Tibia	Tarsus	Foot
53760	35.0	16.0	13.2	18.0	19.0	12.0	14.0
53761	38.5	16.0	13.5	20.0	20.5	14.5	17.0
53759	36.0	15.0	14.0	19.0	20.2	12.3	15.7
53758	40.0	16.5	15.2	18.5	19.0	12.5	16.0

[a] These measurements are only close approximations, since accurate measurements have been impossible. The character of the preservation has left the specimens very brittle, and movement of the limb or digits results in their being broken. All the specimens have the head bent strongly downward, that of the type being nearly at right angles to the body.

REMARKS: Previously described are six species that may be regarded as correctly associated with *Plectrohyla.* These are *guatemalensis* Brocchi (the genotype), *sagorum* Hartweg, *matudai* Hartweg, *ixil* Stuart, *quecchi* Stuart, and *cotzicensis* Stuart. Of these, *sagorum* and *matudai* are from southern Chiapas, Mexico. The others are from Guatemala. The species here described extends the known range of the genus about 200 miles to the northwest.

Formerly I regarded *Hyla miliaria* Cope as belonging in this assemblage. However, since I have examined the type (the only known specimen), I doubt that such is the case. The pollex rudiment has different characteristics. It is not penetrated by a spine. There is a strong serrate fringe on the tarsus and forearm, and there are other perhaps significant differences. I do not know whether the quadratojugal is present or not. Until further evidence is forthcoming I shall regard *miliaria* as belonging to another hylid group.

Another form that was originally regarded as being of the same genus as *Plectrohyla guatemalensis* is *Hyla crassa* (Brocchi). Stuart (1942, Occas. Papers Mus. Zool. Univ. Michigan, no. 455, p. 6) continues to list this form as a member of the genus. However, the absence of any trace of the pollex in the type specimen (and this a male having a vocal sac) suggests that the relationship is elsewhere among the hylids.[1] One supposes that Brocchi's data and figure are substantially correct (1882 [1883], Étude des batraciens de l'Amérique Centrale. Mission Scientifique au Mexique, livr. 2, p. 64, pl. 12).

The relationship of *Plectrohyla brachycephala* to the six known members of the genus may be shown by the synopsis of the genus.

Key to the Species of the Genus *Plectrohyla*

1. Spine of pollex bifid; large species, 59 mm. snout to vent...... *guatemalensis*
   Spine of pollex simple; medium species, 38–45 mm..................... 2
2. A distinct outer metatarsal fold; vocal slits and vocal sac absent; rostrum pointed; canthus rostralis conspicuous, marked by a low ridge; inner tarsal fold present, thick, low; maxillary teeth large, greatly reduced in number, 26–30; 45 mm. snout to vent.................... *cotzicensis*
   No outer metatarsal fold: vocal slits and vocal sac present; inner tarsal fold present, variable in character; rostrum blunt or pointed; maxillary teeth more numerous, 40–60.................................... 3
3. Snout rounded or bluntly pointed at tip; no vertical rostral keel.......... 4
   Snout sharply pointed, with or without a vertical rostral keel............. 5
4. Inner tarsal fold forming a long, free, flexible fringe or flap (.5 to 1 mm. wide); tubercular flaps bordering postanal groove; height of snout a little less than length; canthus angular; vocal slits and ample vocal sac present; areas about nostrils swollen and pustular, with a depression between; dorsal surface strongly pustular; 35–40 mm. snout to vent.... .... *matudai*
   Inner tarsal fold a low ridge not forming a free fringe; no tubercular postanal flaps; height of snout at tip a little greater than length of snout; canthus rounded, skin smooth; area about nostrils not, or but little, swollen, non-pustular, without a distinct depression between nostrils; 35–40 mm. snout to vent............................ *brachycephala*
5. No rostral keel present; arms very strongly thickened; skin smooth; 52–58 maxillary teeth; 39–40 mm. snout to vent.......... .... *ixil*
   A rostral keel present; arms not strongly thickened; skin may be smooth or strongly pustular or tuberculate................................ 6
6. Canthus rostralis not sharply marked save immediately in front of eye; skin relatively smooth with a few scattered small tubercles (rarely smooth without tubercles); inner tarsal fold may be widened distally at the

[1] Stuart (*loc. cit.*) has suggested that *Hyla robustofemora* Taylor is a specimen of *Plectrohyla crassa*, but this is definitely not the case.

inner metatarsal tubercle. Brownish gray to brown mottled with black. 35–41 mm. snout to vent.......................... *sagorum*

Canthus rostralis sharp edged; skin strongly pustulate or tuberculate above; arm extremely thickened, especially in males, with folds at elbow and wrist. Above, drab gray, mottled with dark brownish gray; below gray white. A compressed, free-edged, inner metatarsal fold; 40–44 mm. snout to vent.................................... *quecchi*

I am uncertain to what extent one may judge the character of the vocal sac development by its external appearance. This in most species varies considerably at different times of the year, depending upon calling habits and the elasticity of the skin and musculature of the throat. The presence of the vocal slits is, I feel, the best criterion of the presence of a vocal sac. The species *Plectrohyla matudai* has been reported as not having a vocal sac, yet in topotypic material I have examined, all males show that vocal slits are present, and in some specimens the sac is considerably distended externally. The species *P. cotzicensis* has been reported as lacking vocal slits and vocal sac. This is indeed the case in the single paratypic specimen I have examined (U.M.M.Z. No. 95904).

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A NEW PUFF-BIRD FROM COLOMBIA

BY E. THOMAS GILLIARD

I am greatly indebted to Dr. John T. Zimmer for critically examining the findings reported below, and to Dr. William H. Phelps for the loan of important Venezuelan material.

By coincidence, Phelps had earlier arrived at conclusions similar to mine but postponed reporting them pending the collection of additional specimens. This was discovered shortly after I completed my original manuscript, when he arrived in New York with a long series of *Bucco capensis* from southern Venezuela. Phelps generously insisted that these records be incorporated here.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Bucco capensis dugandi, new subspecies

TYPE: From the Río Duda, eastern foot of Mt. Macarena, southeastern Colombia; altitude 1000 feet. No. 348775, American Museum of Natural History. Adult male collected February 16, 1942, by E. T. Gilliard.

DIAGNOSIS: Similar to *capensis* of northeastern Brazil, the Guianas, and southern Venezuela east of the upper Orinoco region but back distinctly paler, more Amber Brown, less dark Auburn; crown and sides of head paler, more Tawny, less deep Russet.

RANGE: Extending from southwestern Venezuela (Mataben Rapids, San Fernando de Atabapo, Yavita-Pimichín Portage) to southeastern Colombia, eastern Ecuador, and northeastern Perú.

DESCRIPTION OF TYPE: Crown, nape, sides of head, malar region, tail, lower flanks, and under tail-coverts Tawny, the crown with an Amber wash; chin, throat, lower chest, and central abdomen white, the abdomen with a faint Ochraceous-Tawny wash;

primaries, secondaries, nuchal collar, and pectoral band black; back, rump, upper tail-coverts, wing coverts, outer edges of inner secondaries a little more chestnut than Amber Brown; all of dorsal plumage finely vermiculated with black; rictal bristles black. Bill (in dried skin) Yellow Ocher, the maxilla dark gray on outer half. Wing, 83.5 mm.; tail, 66.5; bill from nostril, 20; tarsus, 17.5.

REMARKS: Sexes alike in size and coloration. Although one of the two Phelps Collection specimens from the Yavita-Pimichín Portage on the upper Orinoco is very close to *capensis*, I have included it with *dugandi* in view of the fact that all other specimens at hand from the region clearly belong with the western population.

RANGE OF MEASUREMENT

	Wing	Tail	Bill from Nostril
B. c. capensis			
4, British Guiana	84–90	60–67.5	21–22.5
12, southern Venezuela	83–89	59–67	20.5–22.5
B. c. dugandi			
5, southeastern Colombia	83–87	59–66.5	19.5–21
3, eastern Ecuador	88–88.5	61.5–64	20–24
2, northeastern Perú	88–89	—	20.5–21

Latham's *Bucco collaris* (1790, Index ornithologicus, vol. 1, p. 202) seems to be the only other name which has ever been applied to Linnaeus' *B. capensis*. It appears as a marginal heading beside the original name and reference to Linnaeus' bird and, quite obviously, was used in error.

This form is named in honor of our friend Dr. Armando Dugand, Director del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia, who played a major part in making the Mt. Macarena Expedition a success.

SPECIMENS EXAMINED

B. c. capensis:
BRAZIL:
Pará, 1 (?).
BRITISH GUIANA:
Mines District, 2 (?); Kamakusa, 1 ♀; Kamarang River, 1 ♂; Kako River, 1 ♀[1].
VENEZUELA:
Mt. Paurai-tepui, 1 ♂[1], 1 ♀[1]; west slope, Mt. Paraque, 1 ♀[1]; base of Mt.

[1]Phelps Collection, Caracas, Venezuela.

Guaiquinima, 2 ♀[1]; Río Paragua, Raudal Guaiquinima, 1 ♀[1], 1 (?); Carabobo Mine, upper Río Cuyuni, 1 ♂[1]; Mt. Auyan-tepui, 1 ♀; Mt. Aprada-tepui, 1 ♂[1]; La Unión, 1 ♂; La Prisión, 3 ♂.

B. c. dugandi:

VENEZUELA:

San Fernando de Atabapo, 1 ♀[1]; Mataben, 1 ♀; Yavita-Pimichín Portage, 2 ♂[1].

COLOMBIA:

Florencia, 1 ♂; La Morelia, 1 ♂; "Bogota," 2 (?); eastern foot of Mt. Macarena, 1 ♂ (type).

ECUADOR:

Río Suno, above Avila, 2 ♂, 1 ♀.

PERÚ:

Boca Río Curaray, 1 ♂; Perú, 1 (?).

[1]Phelps Collection, Caracas, Venezuela.

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DESCRIPTIONS OF THREE NEW LONGICORN BEETLES WITH A KEY TO THE SPECIES BELONGING TO THE GENUS *NYSSICUS* (COLEOPTERA, CERAMBYCIDAE)

BY LIONEL LACEY

In describing these beetles I have had the advantage of obtaining from two sources specimens for comparison, and of having the manuscript checked to a great extent by those who supplied the specimens, so I wish to tender my thanks to Dr. E. Gorton Linsley and to Dr. M. A. Cazier, and to express my appreciation of their kindly and valuable help.

Eburia linsleyi, new species

Robust, uniformly dark brown pronotum with seven elevated glabrous areas, side margins tuberculate medially; pronotum widest in front of middle in male, at the middle in female; each elytron with four glabrous lines extending from base to near apex; base of each elytron with one or two small eburneous spots, middle of each elytron with two small eburneous spots.

MALE: Vestiture: Head with long, erect, ochraceous hairs on front between antennal tubercles, and vertex clothed with whitish and yellowish recumbent hairs; border of labrum clothed with ochraceous hairs, labrum with a subtriangular depression in front sparsely clothed with suberect ochraceous hairs; antennal scape moderately clothed with recumbent and suberect yellowish hairs, remainder of segments densely clothed with yellowish recumbent hairs, segments 1 to 6 ciliate on the inner margins. Pronotum covered with whitish recumbent hairs except for seven moderately elevated glabrous areas; transverse posterior depression partly clothed with small, recumbent, ochraceous hairs. Scutellum

clothed with yellowish recumbent hairs. Elytra moderately densely clothed with short whitish hairs and scattered suberect ochraceous hairs; the two eburneous spots at center with several ochraceous setae both externally and internally. Legs with femora, tibiae, and tarsi densely clothed with suberect and depressed hairs. Prosternum, mesosternum, metasternum, and abdominal segments moderately densely clothed with recumbent white hairs intermixed with scattered long, coarse, erect, and suberect ochraceous hairs.

Structure: Head narrower than pronotum; front between the eyes deeply carinate medially, transverse impression below antennal insertion extending across front, surface deeply, rugosely punctate, carinae around antennal insertions, deep, shallow carina across top of head behind the eyes; antennae about one-third longer than body; scape incrassate, segment 3 longer than segments 4, 5, 6, 7, 8, 9, and 10, and as long as segment 11. Pronotum globular, coarsely, irregularly punctate; there are seven glabrous areas, one on each side in front of disc, one on each side of disc at center, one medially behind disc, and one elongate on each side behind disc, reaching posterior margin. Scutellum subtriangulate. Elytra elongate, parallel; two elongated, oval, basal, eburneous spots, slightly nearer to the suture than to the lateral margin; four elongated, oval, eburneous spots at center, slightly nearer to the suture than the lateral margin and placed on glabrous lines as are the basal spots; four elongated, glabrous, denuded lines on each elytron extending from base to near apex; apices of elytra evenly rounded, unispinose, spines extending from the suture; surface coarsely, irregularly punctate, punctures separated by about twice their own widths.

FEMALE: Not so robust as male. Pronotum subglobular, with a prominent spine laterally, slightly behind the middle; antennae about three-quarters length of body; elytra same as male except that there are four eburneous basal spots, the apices are truncate, and the sutural spines very small.

MALE: Length, 22 mm.; width, 6 mm.

FEMALE: Length, 18 mm.; width, 5 mm.

TYPE MATERIAL: Holotype, male, collected in Oak Creek Canyon, Arizona, by W. P. Medlar August 21, 1941. Deposited in the American Museum of Natural History. Allotype, female, collected by J. N. Knull in the Chiricahua Mountains, Arizona, on July 14, in his collection. One male paratopotype in author's

collection, collected by W. P. Medlar. Three female paratypes: one collected in Bagdad, Arizona, by G. F. Maughmer on August 20, 1939, in the American Museum of Natural History collection; two in the collection of J. N. Knull (one collected by H. H. Kimball at Paradise, Arizona; the other with label "Arizona").

This species is named in honor of Dr. E. G. Linsley as a very humble tribute to the work he has done, and is still doing, in the furtherance of knowledge of the Cerambycidae.

This species is apparently most closely related to *Eburia conspersa* Horn, but is readily distinguished from it by being uniformly dark brown, by having a deeper impression on front of head below the antennal insertions, by having a transverse impression behind the eyes, by the differently shaped pronotum, and its median lateral spine, by having four glabrous lines on each elytron, and by the lack of the large setigerous punctures on the elytra. *Eburia linsleyi* can be distinguished from *E. nigrovittata* Bates, being uniformly dark brown, by having a deeper impression on front of head below antennal insertions, by having a transverse impression behind the eyes, by the differently shaped pronotum, by a more acute lateral spine on pronotum, by having four glabrous lines on each elytron, and by having no elevated costae or setigerous punctures on elytra. This species does not appear to be closely related to any other previously described species from the United States.

Key to the Species of the Genus *Nyssicus*

1. Pronotum black at base and apex, disc without black areas (Peru) .... *conspicillatus* Erichson
— Pronotum not black at base 2
2. Elytral apices unispinose (Tapajos, Brazil) .... *quadrinus* Bates
— Elytral apices bispinose 3
3. Pronotum with four dark discal areas, elytra with humeral maculae densely clothed with short, recumbent, golden pile (Peru) .... *aureopilosus*, new species
— Pronotum with fewer than four dark discal areas, elytra with humeral maculae sparsely clothed with white, recumbent pubescence 4
4. Pronotum with two dark areas, antennal scape not tuberculate 5
— Pronotum with three dark areas, antennal scape tuberculate (Brazil) .... *quadriguttatus* Sweder
5. Elytral maculations divided medially with a pigmented area giving the impression that each macula consists of two separate areas, femora not clavate (America) .... *quadrimaculatus* Forster[1]

[1] Judging by the description and illustration given by Forster (1785, Fuessly, Archiv., vol. 6, pp. 13, 32, fig. 3) this species probably belongs in another genus. However, it is included here until such time as adequate material is available to determine its status. In the above publication the pronotum is shown to be quadrispinose and the femora are not clavate.

— Elytral maculations not divided medially, femora clavate (Barro Colorado Island, Canal Zone) .... *setosus*, new species

Nyssicus aureopilosus, new species

Form moderately robust, color light brown, pronotal disc with five small elevated areas, lateral margins with blunt tubercle at middle, scutellum clothed with dense golden pubescence, elytra with two oblong, subovate, basal maculae that are clothed with dense golden pubescence, two postmedian subovate maculae clothed with short recumbent yellow pile, basal maculae margined with black apically, postmedian maculae with black area extending from base laterally for almost their entire length, apices of maculae with a narrow black line extending from the sutural side for about one-third of the distance towards elytral apices, elytral spines black.

MALE: Vestiture: Head and pronotum moderately, densely clothed with short, recumbent, yellowish pile; antennal segment 3 with scattered erect setae externally, becoming less abundant on segments 4 to 10. Pronotum with basal median flat plate densely clothed with fine, recumbent, golden pile. Scutellum densely clothed with suberect golden pubescence. Elytra with two large basal oblong maculae clothed with dense, short, recumbent, golden pile, two postmedian subovate maculae clothed with minute, yellow, recumbent pile, remainder of the elytra clothed with minute, yellow, recumbent pile, surface with scattered minute suberect hairs, arising from punctures, and a subsutural row of long suberect setae, arising from tubercles, with a few suberect setae scattered behind anterior maculae. Ventral surface densely clothed with short recumbent pubescence, and sparsely, irregularly clothed with long pale hairs, mesepisternum and metepisternum densely clothed with short, recumbent, golden pile. Legs, femora sparsely, irregularly clothed with long, erect, yellowish pile, and suberect setae, anterior and middle tibiae densely clothed on inner surface with short, suberect pile, exterior surface with short, scattered, suberect setae, posterior tibiae densely clothed with long, erect, yellowish pile, exterior surface with scattered suberect setae, tarsi sparsely clothed above with yellowish pile, under surface of first three segments densely clothed with short, erect, yellowish pile.

Structure: Head narrower than pronotum, front with a median longitudinal sulcus extending from base to clypeal suture, surface

shallowly punctate, punctures irregularly placed, interspersed with dense micropunctures; clypeal suture deeply impressed, clypeal surface irregularly, shallowly punctate on basal third, apical two-thirds impunctate; labrum shallowly emarginate anteriorly, sparsely punctate on basal half, apical half impunctate; antennae about one and one-half times as long as body, scape incrassate, shallowly, sparsely, finely punctate, antennal segments 3 and 7 longer than segments 4, 5, 6, 8, 9, and 10; segment 7 longer than segment 3, with segment 11 subequal to segment 3, and slightly curved, segments 3 to 9 strongly spined apically on the inside, segments 3 to 9 distinctly carinate on inner margin, segment 10 faintly carinate, segment 11 not carinate. Pronotum broader than long, anterior margin arcuate medially, surface broadly, transversely impressed in front of disc, a black macula on the lateral margin in front of lateral tubercle, two black maculae on either side of disc medially, two median lateral gibbosities in front of disc laterally, two slightly elevated areas behind disc laterally, disc broadly elevated, posterior margin incised, trilobed, a broad, median lobe extending forward as a flat, somewhat rounded plate, marked by a deep arcuate impression which is transverse on posterior lateral lobes, side margins with median blunt tubercles, light brown, surface shallowly punctate, punctures separated by about their own widths, discal black areas cribrately punctate. Scutellum rounded apically. Elytra with four maculae, basal golden maculae oblong, subovate, bordered behind by a narrow lunulate black band, postmedian maculae white, subovate, bordered basally and laterally by a continuous black area which is subtriangular anteriorly, with a narrow brown area extending from the inner apical margin about halfway to the apex of the elytra, apex of the elytra with a dark external spot continuous with lateral spines, elytral apices bispinose, apical margins between apices truncate, humeral angles moderately produced, surface shallowly, irregularly punctate, and tuberculate on basal two-thirds, punctures separated by about their own widths, apical third impunctate, sparsely, irregularly tuberculate. Legs yellowish brown with apices of femora and bases of tibiae dark brown, femora incrassate postmedially, narrowly towards apex, middle and posterior femora with two sharp apical spines, tibiae with two sharp apical spines, inner and outer surfaces strongly carinate.

FEMALE: Same as male, but the antennae are about one and two-fifths longer than body, segments 3 to 7 ciliate internally, seg-

ment 3 longer than succeeding segments 4 to 11, which are subequal, elytra without tubercles behind postmedian maculae, apical third of elytra sparsely, shallowly punctate, punctures separated by about three to four times their own widths.

MALE: Length, 26 mm.; width, 6 mm.

FEMALE: Length, 27 mm.; width, 5.5. mm.

TYPE MATERIAL: Holotype collected at Satipo Valley, Junin Province, Peru, June, 1940, received through Anton Maller; deposited in the American Museum of Natural History collection. Allotype: female, same locality as holotype, collected September, 1941, received through Anton Maller; deposited in the American Museum of Natural History collection. Paratypes: two males and one female from Satipo, Peru, October, 1939; one male and one female in author's collection, one male deposited in the American Museum of Natural History collection.

This species is apparently most closely related to *Nyssicus quadriguttatus* Sweder, but is easily separated from it by the absence of the tubercle on the inside of the scape, by having the antennal spines straight, the basal third of the clypeus punctate, by its more deeply emarginate labrum, two lateral black maculae on the pronotum, the anterior median dark area lacking, the dark areas on the pronotum more densely punctate than the surrounding area, by the golden pile on the scutellum, and the basal elytral maculae, postmedian maculae single, elytral apices truncate between the spines, by the denser punctation on the basal two-thirds of the elytra, presence of the golden pile on the mesepisternum and the metepisternum. In *Nyssicus quadriguttatus* the antennal scape has a small tubercle on the inner surface, the antennal spines are curved backward, the clypeus is glabrous throughout, the labrum is less deeply emarginate, the pronotum has one anterior dark medial area, and two dark lateral discal areas, these areas are less densely punctate than the rest of the surface, the basal elytral maculae are smaller and are clothed with short, recumbent, white pile, the elytral punctures are separated by about two to three times their own widths, the apices of the elytra between the spines are cut obliquely back to the suture, the mesepisternum and metepisternum are densely clothed with short, recumbent, white pile, the postmedian maculae not subovate, lateral margin extending more towards the apex than the inner margin.

Nyssicus setosus, new species

Form narrow, elongate, color testaceous, pronotal disc with four elevated areas and two black maculae, lateral margins with acute tooth slightly behind middle, scutellum sparsely clothed with recumbent white pile, elytra with two white, subovate basal maculae, sparsely clothed with short recumbent white pile, two white, subovate, post-median maculae, sparsely clothed with short recumbent white pile, basal maculae margined with brown apically, post-median maculae bordered with brown basally and apically, elytral apices bispinose, spines reddish brown.

MALE: Vestiture: Head from base to clypeal suture densely clothed with white recumbent pile; basal half of clypeus sparsely clothed with short yellowish hairs with one long yellowish seta laterally, apical half of clypeus glabrous; labrum with scattered long yellowish hairs; antennal scape sparsely covered with short yellowish hairs, with long, suberect setae externally, segments 2 to 11 densely clothed with short, recumbent, yellow hairs, segments 2 to 8 densely ciliate beneath, segments 9 to 11 sparsely ciliate beneath, segments 2 to 7 with long, scattered setae. Pronotum with disc densely clothed with short recumbent pile, lateral margins densely clothed with long yellowish pile, basal median flat plate densely clothed with fine recumbent yellowish pile. Scutellum densely clothed with recumbent white pile. Elytra with two basal subovate maculae sparsely clothed with short recumbent white pile, two post-median, oblong, subovate maculae clothed with minute white recumbent pile, remainder of elytra densely clothed with short, white, recumbent pile with a subsutural row of long, suberect setae, and scattered setae over remainder of surface, punctures with minute suberect setae. Ventral surface densely clothed with short whitish recumbent pile, ventral abdominal surface with scattered suberect setae on each ventral segment, more numerous on fourth and fifth segments, mesasterna and metasterna sparsely clothed with suberect setae. Legs with femora moderately densely clothed with white, recumbent pile, with numerous scattered, suberect setae, middle and posterior femora similar to anterior femora except that the setae on both are more numerous, anterior tibiae clothed internally with yellowish hairs, interspersed with long yellowish setae, middle and posterior tibiae with long brownish hairs, interspersed with suberect, brownish setae, tarsi with segments 1 to 3 densely clothed beneath with short, erect, yellowish hairs, form-

ing pads, dorsal surface of segments 1, 2, 3, and 5 sparsely clothed with long, suberect, yellowish hairs.

Structure: Head narrower than pronotum, front with a median longitudinal sulcus extending from basal third to clypeal suture; clypeal surface shallowly punctate on basal half, apical half impunctate, anterior margin truncate; labrum shallowly emarginate anteriorly, sparsely, shallowly punctate; antennae about one and three-quarters times longer than body, scape incrassate, shallowly, sparsely, finely punctate, antennal segments 3 to 8, 9, and 11, which is curved, subequal, segments 5, 6, and 7 subequal, shorter than segment 3, but longer than segments 8, 9, and 11, segment 4 shorter than segment 3 and subequal to 10, segments 4, 5, and 6 strongly spined apically on the inside, segments 3 and 7 with short spines apically and carinate on inner margin. Pronotum broader than long, a black tuberculate macula, surrounded by a narrow band of brown, on each side of disc, slightly in front of middle, a slightly elevated impunctate area below black tuberculate maculae at center, and two elongate, elevated oblique areas extending from basal median flat plate to lateral margins of black maculae, hind margin trilobed, posterior margin incised, a broad median lobe extending forward as a flat, somewhat subspherical plate, marked by a deep arcuate impression, which is transverse on posterior lateral lobes, side margins with post-median blunt tubercles, remainder of surface deeply punctate, punctures separated by about their own widths. Scutellum subtriangular, rounded apically. Elytra with four maculae, basal white maculae subovate, somewhat flattened at apex, bordered behind by a black, triangular band, sparsely minutely punctate throughout, punctures separated by about five to seven times their widths, post-median maculae white, impunctate medially, sparsely punctate around margins, bordered apically and basally, with brown, elytral surface moderately punctate, punctures separated by about twice their own widths, elytral apices bispinose, cut back obliquely from apical spine, apical spines longer than sutural spines, reddish brown. Legs testaceous, femora subclavate, middle and posterior femora bispinose at apex, spines short and acute, tibiae bispinose apically.

Male: Length, 17 mm.; width, 4 mm.

Type Material: Holotype, male, collected on Barro Colorado Island, Canal Zone, March 30, 1940, by Mr. G. C. Wood; in collection of the American Museum of Natural History.

This species is apparently most closely related to *Nyssicus*

quadriguttatus Sweder, but is easily separated from it by the absence of the tubercle on the inside of the antennal scape, by having the apical spine on the third antennal segment short, by having the basal half of the clypeus punctate and pilose, by having only two black maculae on the pronotal disc, by the absence of tubercles on the apical half of the elytral surface, and by having the apical elytral spines reddish brown. In *N. quadriguttatus* the antennal scape is tuberculate on the inner margin at basal third, the apical spine on the third antennal segment is long and subequal to the spines on fourth and fifth segments, the entire clypeus is impunctate, the pronotum has three dorsal maculae, surface of the apical half of the elytra is tuberculate, and the apical elytral spines are black.

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GENITALIC VARIABILITY IN A SPECIES OF MOTH OF THE GENUS *EACLES* (LEPIDOPTERA, SATURNIIDAE)

BY JOSÉ OITICICA FILHO AND CHARLES D. MICHENER

In the study of the taxonomy of many groups of animals the male copulatory organs play an important part. Often it is easier to determine a species by examination of these structures than in any other way, and in many groups of insects these structures are believed to be less variable within a species than are other morphological features.

Because of these facts it has often been assumed that the genitalic structures of the male and female fit in a lock and key fashion and are important among the isolating mechanisms that prevent interbreeding of closely related species. As has been indicated by Goldschmidt (1940) and Dobzhansky (1941), this point has been greatly overemphasized, although isolation of this sort may occasionally be important.

In the genus *Eacles*, although the species are for the most part distinguishable by external characteristics, the male genitalia are usually rather constant in structure and provide valuable specific characters. It is therefore of unusual interest to find in a series of *Eacles manuelita* Oiticica such extreme variability in genitalic structure that at first it seemed that two or three species must be involved.

Externally the 14 known male specimens of this species look very much alike, all being similar to the holotype figured by Oiticica (1941). The holotype, and only previously known male specimen, has been available for direct comparison with the series of 13 additional specimens. In some individuals the basal brown markings of the hind wings are less conspicuous than in the holo-

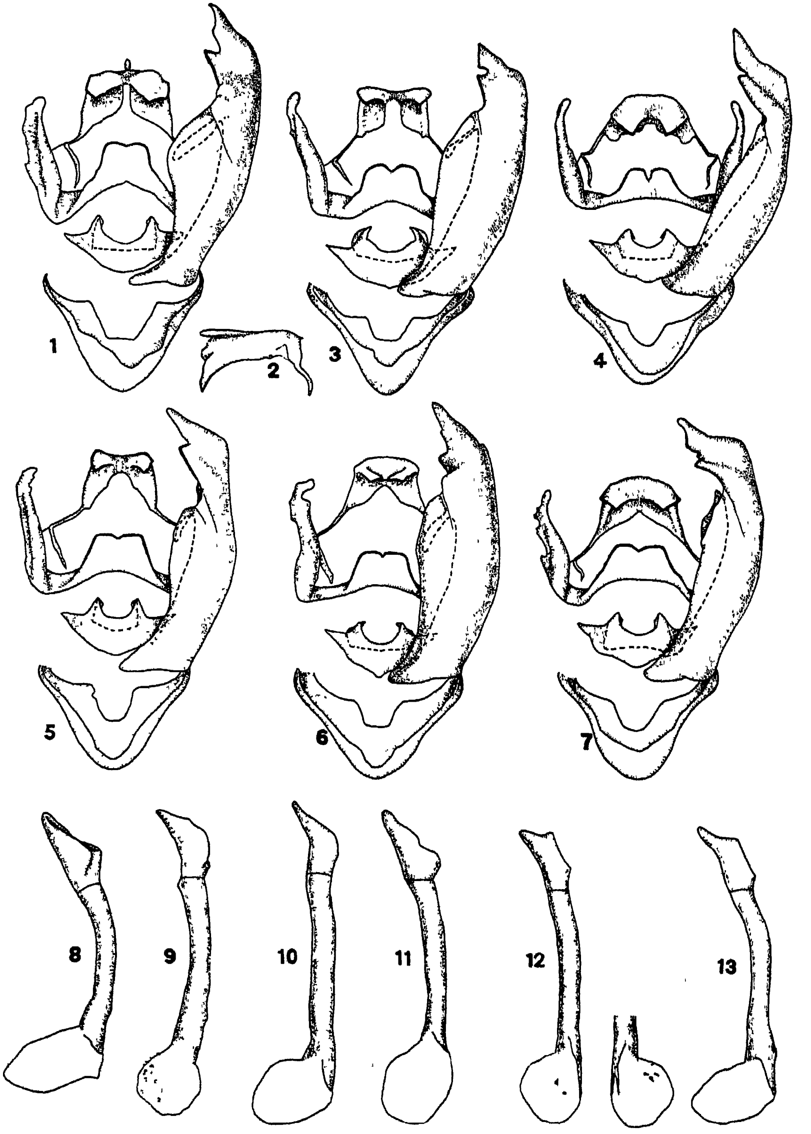


FIG. 1. Ventral view of male genitalia of holotype from Alagôas.

FIG. 2. Lateral view of uncus of same.

FIGS. 3–7. Ventral views of male genitalia: 3, specimen from Sergipe, genitalic preparation 4007, U.S.N.M.; 4, specimen from Sergipe, genitalic preparation 1581, A.M.N.H.; 5, specimen from Pernambuco, genitalic preparation 1582, A.M.N.H.; 6, specimen from Pernambuco, genitalic preparation 1583, A.M.N.H.; 7, specimen from Sergipe, genitalic preparation 1584, A.M.N.H.

FIGS. 8–13. Aedeagi: 8, holotype; 9, 4007; 10, 1581; 11, 1582; 12, 1583, with apex shown from opposite side; 13, 1584.

type, and in some the broad apical brown band of the hind wing is more yellowish, especially subapically. Otherwise very little variability was noted. Clearly there is less variability in color and pattern among available specimens of *E. manuelita* than among specimens of most species of *Eacles*.

The type specimen of *E. manuelita* is from the state of Alagôas, Brazil. Five specimens are from Pernambuco, Brazil, and eight from Sergipe, Brazil. All these localities are in a small area at the eastern extremity of Brazil. Although unfortunately the labels on the specimens give only the states in which they were collected and not precise localities, this area cannot be much over 300 miles long, the states concerned all being relatively small in size.

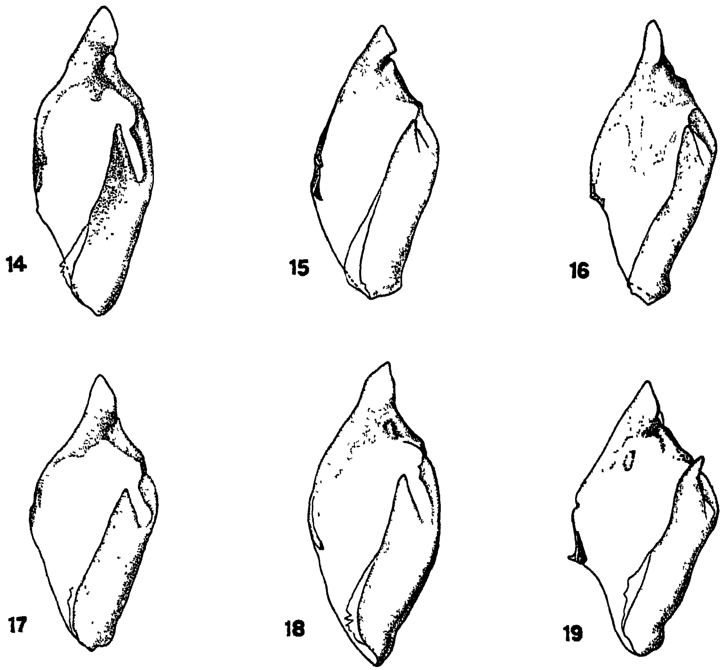
The range of variability of various genitalic structures is shown in the figures. The type specimen from Alagôas, a locality between Pernambuco and Sergipe, is unique in having a short subapical dorsal projection on the uncus (figs. 1 and 2). It also has the posterior lobes of the ninth tergum larger than in other specimens, although there is much variability in their size in the others, and in a few they are nearly as large as in the type.

The claspers vary markedly in shape. Not only are there differences in their dentition, but also in their general shape. They may be slender, as in the Alagôas specimen (fig. 14), or much broader, as in the specimen from Sergipe shown in figure 19. Every intergradation between these extremes exists.

The sac of the aedeagus is usually without spines or spicules in this species. However, in one specimen from Pernambuco there is a single minute spicule, in another (fig. 12) there are five or six, and in one specimen from Sergipe (fig. 9) there are numerous strong spicules.

In spite of this wide range of variability, the genitalia of *E. manuelita* are recognizably different from those of other *Eacles*, except *E. ducalis* Walker, 1855.[1] The genitalic variability here demonstrated eliminates the supposed differences in the male genitalia between *manuelita* and *ducalis*. This is especially true since a specimen of *ducalis* from Rio Vermelho, Santa Catarina,

[1] *Eacles manuelita* was originally described as a close relative of "*E. penelope ducalis*" Walker, 1855. This name was used by Oiticica (1941) because it was supposed that *ducalis* was a subspecies of *E. penelope* (Cramer) (1775, p. 70, pl. 45, fig. A ♂). We now know that *E. penelope* (Cramer) is the species also known as *E. majestalis* Draudt (1929, pl. 133b; 1930, p. 802) and that *E. ducalis* described by Walker (1855, p. 1374) from Rio de Janeiro is a quite different species from *E. majestalis* Draudt = *E. penelope* (Cramer).



FIGS. 14–19. Inner views of harpes: 14, holotype from Alagôas; 15, specimen from Sergipe, genitalic preparation 4007, U.S.N.M.; 16, specimen from Sergipe, genitalic preparation 1581, A.M.N.H.; 17, specimen from Pernambuco, genitalic preparation 1582, A.M.N.H.; 18, specimen from Pernambuco, genitalic preparation 1583, A.M.N.H.; 19, specimen from Sergipe, genitalic preparation 1584, A.M.N.H.

Brazil, in the collection of the American Museum of Natural History (genitalic preparation 173) has a dorsal process on the uncus similar to that of the holotype of *manuelita*, although slightly smaller. Thus the genitalic variability of *ducalis* is very striking, although not so great as that of *manuelita*. The differences in color pattern, and perhaps those of the female genitalia (Oiticica, 1941), remain to differentiate *manuelita*, which we suspect may be a subspecies of *ducalis*, rather than a distinct species.

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We are much indebted to Mr. Frank Johnson of Griffin, Georgia, who assembled the Pernambuco and Sergipe specimens of *E. manuelita* and who has extensively supported the work on

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A NEW PANAMA *ECITON* (HYMENOPTERA, FORMICIDAE)

BY NEAL A. WEBER[1]

The ants of the genus *Eciton* are the conspicuous terrestrial army ants of the American tropics. Those species having soldiers with large, fishhook-shaped mandibles are few in number, and constitute the subgenus *Eciton*. *Eciton hamatum* and *burchelli* occur over a large area of the American tropics and have been the chief subjects of the well-known studies by T. C. Schneirla, particularly from the point of view of their fascinating behavior and the underlying biological processes concerning brood production which condition it very intimately.

Schneirla, in the course of studies on Panama ecitons in late 1947, took a species of the subgenus *Eciton* which is described below. The species of this subgenus are so highly polymorphic that considerable caution is advisable in describing new forms until the range of variability has been worked out. The data obtained by Schneirla, however, warrant a name for his species, so clearly distinct morphologically from *hamatum* and *burchelli*.

The taxonomic history of the species of *Eciton* is a story of unusual confusion. The early collectors in the American tropics occasionally took the winged males at lights, along with other insects, and these were described as wasps. In the meanwhile the large soldier caste with mandibles like fishhooks had been described under various generic names. The realization that the males were really ants came much later. Still later came the correlating of males with soldiers or workers, a process which is likely to go on for some time, since many species are still known by only the male or only the soldier and worker castes.

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The males of *Eciton* show distinctive species characters, and the temptation has been great to describe an unusual specimen as a new species differing from known males. Menozzi (1926) has been one of the latest describers on this basis, and his *E.* (*E.*) *velutatum* from Costa Rica has yet to be correlated with the other castes.

There is no evidence linking *velutatum* with the present described species so that those known in the soldier caste may be considered. Of these species, two have a tooth on the median border of the mandibles as does the Panama species, and it appears to be intermediate between them. They are *lucanoides* Emery, described from Peru, and *quadriglume* (Haliday), described from Brazil. The *lucanoides* soldier has the median mandibular tooth much longer and narrower, becoming almost recurved, while the *quadriglume* soldier has more slender mandibles with the median tooth much less developed.

Eciton lucanoides was figured originally by Emery as having a straight, rather than impressed, occipital margin and with the above mandibular characters. Mann (1916) recorded it from Brazil, and Borgmeier (1936) from Nicaragua and Costa Rica. Mann states that he was "unable to distinguish the minors and mediae of *E. lucanoides* from those of *E. hamatum* by any single character." The present Panama species, the sculpture and color of which in the worker caste are those of *hamatum*,[1] shows distinct differences in the pedicel and therefore is not likely to be cospecific with Mann's Brazilian specimens. The question then arises as to the correctness of identification of the Nicaraguan and Costa Rican specimens. They may be cospecific with the Panamanian form, and future study may serve to demonstrate the limits of variability of *lucanoides*.

Eciton quadriglume is summarized as follows by Santschi: "Cette belle espèce est facile à distinguer par sa couleur noir et mate chez les ☿ et dont la tête et le dessus du thorax vire au rouge sombre chez les ♃. Les épines epinotales sont bien plus longues que leur intervalle." Bruch's excellent photographs also indicate a darker form than the Panamanian species and one with mandibles with a greatly reduced median tooth, appearing in the photograph as being merely a slight convexity at this site.

[1] Schneirla reports that in life the workers of this species were all distinctly darker in coloration than those of the two colonies of *hamatum* observed in the same (type) locality.

Distinct differences in proportions of the pedicel also appear. The species occurs in a number of the Brazilian states, including the southernmost, and in Misiones, Argentina.

The Panamanian form is therefore described as a new species, as follows:

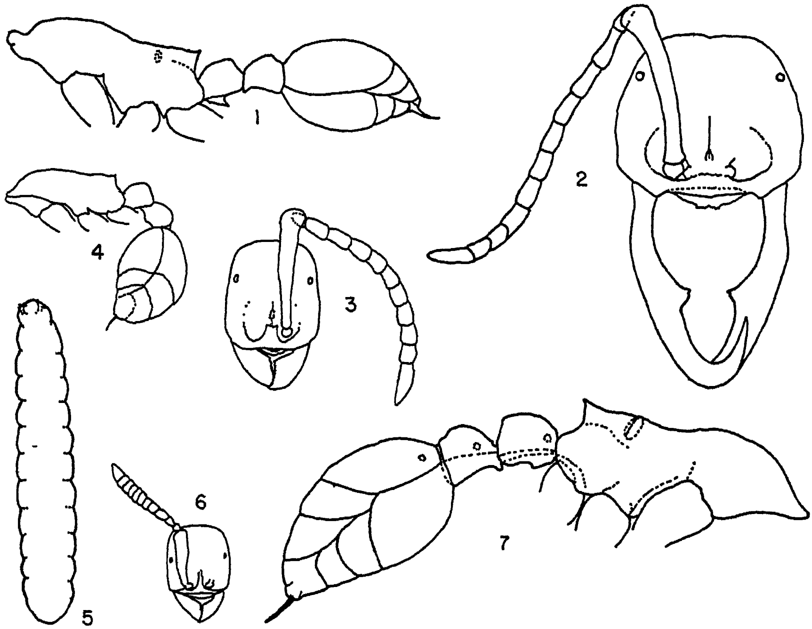
Eciton (Eciton) conquistador, new species

SOLDIER: Total length extended, including head, 11.7–13.5 mm.; of head, including mandibles, 5 mm.; of thorax, 3.5 mm. Head in front view, excluding mandibles, 2.2–2.5 mm. long by 2.5–2.7 mm. wide, being distinctly wider than long, occipital margin impressed, sides convex and broader anteriorly than posteriorly, anterior clypeal margin feebly convex; lateral clypeal margins produced as a triangular, convex lobe directed towards the antennal insertions; eyes convex, 0.15–0.18 mm. in diameter; mandibles long and slender, the apical tooth acute and recurved, near the middle of the median border a second tooth arises from an obtusely angulate, broad base, distal to this may or may not arise a slight, broad convexity; antennal scapes exceeding occipital corners, slightly bowed and enlarged distally. Thorax from above convex through the pronotum at the sides, impressed in the pro-mesonotal region and with sides of epinotum straight, converging slightly posteriorly; in side view sinuate dorsally, the pronotum and basal surface of the epinotum slightly convex; basal epinotal surface with a lamina on each side fusing distally, where produced as a pair of triangular teeth, the fused lamellae continue down the declivous surface as a short median lamella. Petiole from above rectangular, sides slightly convex, broader behind than in front. Post-petiole from above about one-third broader than the petiole, sides convex and strongly converging anteriorly. Gaster small and ovate; legs long and slender.

Dull, being finely and densely punctate over the entire body and appendages; mandibles in addition carrying short and irregular rugae.

Head brownish yellow with anterior margin infuscated, antennae brown with funiculi darker than the scapes, mandibles dark brown; remainder of body brown with a ferruginous tinge.

WORKER: Length, 3–7 mm. Dull, being finely and densely punctate as in the soldier, the mandibles having in addition slight



SPECIMENS FROM TYPE COLONY OF *Eciton conquistador*

FIG. 1. Lateral outline of 7-mm. worker thorax and abdomen with thorax length of 2.5 mm.

FIG. 2. Frontal view of head of soldier.

FIG. 3. Frontal view of head of 7-mm. worker of figure 1.

FIG. 4. Lateral outline of 4.5-mm. worker thorax and abdomen with thorax length of 1.6 mm.

FIG. 5. Outline of 4.5-mm. larva from below. The uniformly simple hairs are not indicated.

FIG. 6. Frontal view of head of 4.5-mm. worker.

FIG. 7. Lateral outline of soldier thorax and abdomen.

and short rugae. Ferruginous, the body and legs being concolorous except for infuscated anterior margin of head and dark brown mandibles and antennae.

TYPE LOCALITY: Area above confluence of Boqueron and Pequeni rivers, tributaries of the Chagres, Republic of Panama, December 15, 1947, T. C. Schneirla. Cotypes in the American Museum of Natural History and in my collection.

It is interesting to note that the two recorded colonies of this eciton were found in the general area of the Camino Real or Las Cruces trail over which, during the Spanish colonial period, pack trains carried gold from Panama City and from the mine

at Candelaria to the Caribbean termination of the route at Porto Bello, for transshipment to Spain. In view of this background, it has seemed very appropriate to accept Schneirla's suggestion that the species be named "*conquistador*."

BEHAVIOR AND BIOLOGICAL CONDITION OF THE COLONIES

(From notes furnished by T. C. Schneirla)

During a five-day survey of the forested Candelaria area above the confluence of the Pequeni and Boqueron rivers, two colonies of this species were found at well-separated points. Within the same period three colonies of *E. hamatum* and just one of *E. burchelli* were found, a fact which suggests that the newly described species is not uncommon in this region in comparison with these other species of *Eciton* (*Eciton*). Thorough searching at Barro Colorado Island, Canal Zone, on the other hand, and surveys in the El Real district of Darien, and also in El Valle, to the east and west of the Canal Zone in Panama, have not disclosed any examples of the species.

COLONY I: Found on November 15, 1947, about 1300 meters west of the Pequeni River, bivouacked within a hollow hardwood tree. The cluster was formed behind a thick partition within the basal hollow of the tree, somewhere within 1 meter from the ground. At 11:30 A.M. a single tree-like system of raiding columns was found, connecting with the bivouac by a single basal column. The presence of scattered debris below the hole through which the ants entered the tree, mainly the empty pupa cases of various ant species (i.e., the remnants of booty objects), indicated a stay of some duration at the site. On November 16 the raiding seemed heavier than before, both along the route of the preceding day and on a new raiding system. The increased magnitude of raiding was indicated by the fact that even after 9:30 P.M. that night a steady column of ants containing many booty carriers was seen returning towards the bivouac. On the following day a considerably heavier two-system raid was established. At 4:00 P.M. a fairly thick column of ants was seen leaving the bivouac tree on one of the principal raiding trails of the day, ordinarily (in *E. hamatum* and other species) a sign of the early stages of a colony emigration. At that time, callow workers were seen in the column and huddled beside the route close to the bivouac. An effort was made to enter the bivouac, without success. It is quite possible that the use of ether in this operation blocked a

movement of the colony which might otherwise have occurred on this last night of observation.

It seemed probable that Colony I had been bivouacked in the same site for some time, evidently passing through a statary (i.e., sessile) phase. There were indications of an impending nomadism, not only in the acceleration of raiding and in the occurrence of a persistent afternoon exodus of the last day, but also in the appearance of newly emerged callow workers at the time.

COLONY II: This colony was found at 11:00 A.M. on November 15, at a point about 3 miles to the west of the site of Colony I, and not far from the Boqueron River. When discovered, the colony was raiding vigorously on three tree-like systems of trails, each with a single base route to the bivouac, and large quantities of insect larvae and pupae were coming in. The bivouac was a plug-formed cluster within the interior of a hollow log hulk and near the broken end, where a considerable part of the mass was exposed. Within the cluster a large number of worker larvae was found, estimated to approach the brood magnitude common in *E. hamatum* and *rogeri*. These larvae seemed essentially mature, and numbers of them were being carried to and from places on the log as well as galleries and cavities in its wall where cocoon spinning was in progress. The bivouac cluster was ransacked rather thoroughly without any discovery of the queen, who may well have escaped with streams of larva-carrying workers into the inaccessible upper interior of the log. On the following day this colony was bivouacked at a point about 140 meters from the previous site, within a hollow tree from which the ants issued at a point about 3 meters from the ground. In mid-afternoon there was just one raiding system, with a single long, unbranched, base column extending to the bivouac tree.

This species may be termed a column raider, by virtue of the fact that its forays involve a tree-like system of raiding trails built up from early morning, much as in *E. hamatum*. Once a raid has developed, each trail system connects with the bivouac by a single base column as in *hamatum* and *rogeri*, and the peripheral branch trails end in small groups of foraging workers. The columns are characteristically narrower than those of *hamatum* and both in width and in the behavior of workers on them are roughly transitional between *hamatum* and *rogeri*. As in both of these species, the booty of the newly described species

is almost exclusively composed of the soft-bodied young (larvae and pupae) of other insects, and particularly of ants and wasps.

The circumstances suggested that Colony I was terminating a statary phase with the emergence of a brood of mature workers, and that Colony II passed from its last day of a nomadic phase to its first day of a statary phase (with the effective enclosure of a brood of mature worker larvae) while under observation. In other words, both in its daily forays and in its evident conformity to a rhythmic nomad-statary pattern of life, the condition of this species resembles that previously described for *E. hamatum* (Schneirla, 1938, 1944).

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